

Project Manual

DSPS MODULAR

IMPERIAL VALLEY COLLEGE
IMPERIAL, CA

Construction Documents



707 Brookside Avenue
Redlands, CA 92373
909- 375-3030

JULY 2020
SGH Project No. 19-43100-00

**SECTION 00 01 01
PROJECT TITLE PAGE**

FOR

DSPS MODULAR

PROJECT NUMBER: 19-43100-00

**IMPERIAL COMMUNITY COLLEGE DISTRICT
380 E. ATEN RD., IMPERIAL, CA 92251
760-352-8320
WWW.IMPERIAL.EDU**

PROJECT LOCATION

380 E. ATEN RD., IMPERIAL, CA 92251

PREPARED BY:

SGH ARCHITECTS

707 Brookside Avenue, Redlands, California 92373
909.375.3030
www.sgharch.com

SECTION 00 01 02
PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Project Name: DSPS Modular
 - Project Number: 19-43100-00
 - Imperial Valley College
 - 380 E. Aten Rd.
 - Imperial, CA 92251
- B. The Owner, hereinafter referred to as District: Imperial Valley College District
 - Imperial Valley College District**
 - 380 E. Aten Rd., Imperial, CA 92251
 - www.imperial.edu
 - 760.352.8320

1.02 NOTICE TO PROSPECTIVE BIDDERS

- A. These documents constitute an Invitation to Bid to and request for qualifications from General Contractors for the construction of the project described below.

1.03 PROJECT DESCRIPTION

- A. Summary Project Description: Selective site demolition; sub-grade pad preparation for new modular; coordination of modular building anchorage and installation; routing of existing site utilities to POC at new building to include plumbing, electrical, low voltage & fire alarm systems within modular building; construction of concrete walks and cmu site walls
- B. Contract Scope: Construction, demolition, and installation of modular office building.
- C. Contract Terms: Lump sum (fixed price, stipulated sum), with incentives.

1.04 PROJECT CONSULTANTS

- A. The Architect, hereinafter referred to as Architect: **SGH Architects**
 - 707 Brookside Avenue, Redlands, California 92373
 - www.sgharch.com
 - 909.375.3030

1.05 PROCUREMENT TIMETABLE

- A. Last Request for Substitution Due: 7 days prior to due date of bids.
- B. Last Request for Information Due: 7 days prior to due date of bids.
- C. Bid Opening: Same day, 3 PM local time.

- D. Bids May Not Be Withdrawn Until: 30 days after due date.
- E. Contract Time: To be stated in bid documents.
- F. The District reserves the right to change the schedule or terminate the entire procurement process at any time.

1.06 PROCUREMENT DOCUMENTS

- A. Availability of Documents: Complete sets of procurement documents may be obtained:
 - 1. From District at the Project Manager's address listed above.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 00 01 07

SEALS PAGE

ARCHITECT

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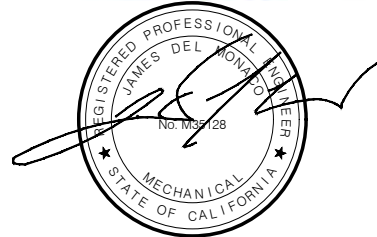
CIVIL

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ELECTRICAL

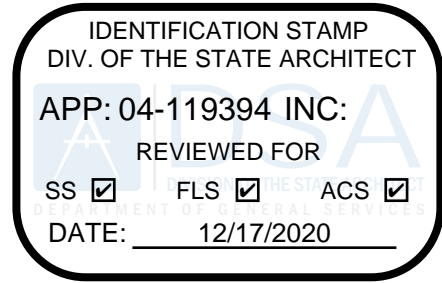
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**SECTION 00 01 07
SEALS PAGE**

ELECTRICAL AND FIRE ALARM

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**SECTION 00 40 25
REQUEST FOR INFORMATION**

RFI NUMBER: _____ **DATE:** _____

PROJECT NAME: DSPS MODULAR – IMPERIAL VALLEY COLLEGE

PROJECT NO.: 19-43100-00

TO: SGH ARCHITECTS

707 Brookside Avenue, Redlands, California 92373

Attention: _____

Contractor: _____

Address: _____

Request By: _____ Date: _____

BRIEF SUMMARY OF RFI: _____

Drawing No. _____ Detail No. _____

Specification Section _____ Title _____

Page _____ Paragraph _____

DETAILS OF THIS RFI: _____

Attachments: _____

RESPONSE WILL BE INCLUDED IN AN ADDENDUM

END OF RFI

SECTION 00 43 25
SUBSTITUTION REQUEST FORM - DURING PROCUREMENT

SUBSTITUTION REQUEST NO. _____

DATE: _____

PROJECT NAME: **DSPS MODULAR**

PROJECT NUMBER: **19-43100-00**

TO: **SGH ARCHITECTS**

707 Brookside Avenue, Redlands, California 92373

From: _____

We hereby submit for your consideration the following product comparisons of the specified product and the proposed substitution. The undersigned fully understands that failure to answer any item below may be cause for rejection of request for substitution.

Request for substitution shall only be made during bidding (not later than 7 days prior to bid opening for inclusion by Addendum) except under conditions beyond control of Contractor.

SPECIFIED PRODUCT: _____

Project Manual Section Title _____ Number ___ Page ____ Paragraph ____.

Drawing No. _____ Detail No. _____

Proposed Substitution: _____

Manufacturer: _____ Tel: _____

- A. Is the point-by-point comparative data attached? — REQUIRED BY A/E
- B. Reason request for substitution is being submitted: _____

DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED PRODUCT

- A. Does proposed substitution affect in any way the Structural Safety, Access Compliance, or Fire & Life Safety portions of the project? No__ Yes__
Explain _____

- B. Does proposed substitution affect dimensions, gages, weights, etc. on Drawing? No__ Yes__
Explain _____

**SECTION 00 63 25
SUBSTITUTION REQUEST FORM (POST-AWARD)**

SUBSTITUTION REQUEST NO. _____

DATE: _____

PROJECT NAME: DSPS MODULAR – IMPERIAL VALLEY COLLEGE

PROJECT NUMBER: 19-43100-00

TO: SGH ARCHITECTS

707 Brookside Avenue, Redlands, California 92373

From: _____

We hereby submit for your consideration the following product comparisons of the specified product and the proposed substitution. The undersigned fully understands that failure to answer any item below may be cause for rejection of request for substitution.

This request for substitution form shall only be used after the end of the bidding period except under conditions beyond control of Contractor.

Specified Product: _____

Project Manual Section Title _____ Number ___ Page ____ Paragraph ____.

Drawing No. _____ Detail No. _____

Proposed Substitution: _____

Manufacturer: _____ Tel: _____

A. Reason request for substitution is being submitted: _____

B. Does proposed substitution affect in any way the Structural Safety, Access Compliance, or Fire & Life Safety portions of the project? No__ Yes__

Explain _____

C. Does proposed substitution affect dimensions, gages, weights, etc. on Drawing? No__ Yes__

Explain _____

D. Does proposed substitution require changes in Drawings or design and installation changes? No__ Yes__

(If yes, cost of Architect and Engineer document changes are the responsibility of the Contractor.)

- E. Does proposed substitution affect product cost, delivery time, or construction schedule?
No__Yes__ Explain _____
- F. Does proposed substitution comply with specified ICC Number, UL Rating, ASTM Numbers?
No__Yes__ Explain _____
- G. Does proposed substitution affect other trades and systems such as wiring, piping, ductwork, structure, etc.? No ____ Yes ____ (Explain which and how) _____

If yes, has impact on their work been included in price of proposed substitution? No__ Yes__.

- H. Does proposed substitution product guarantee differ from that of the specified product?
No__Yes__ Explain _____

If the substitution request is accepted, it will result in:

No cost impact ____ Improve Schedule ____ Credit of \$_____

Attach a listing of 3 projects (one in service for at least 3 years) using the proposed substitution.

Substantiating Data: Attach product data/brochures and Vendor qualifications for both specified and substitute product. Provide samples for both specified and substitute products, if applicable.

Certification: Undersigned has examined Construction Documents, is familiar with specified product, understands indicated application of product, and understands design intent of the Architect caused by the requested substitution.

Submitted by: _____
(Type Name) Signature Date

Signature must be made by person having legal authority to bind his firm to the above terms.

Architect's Comments:

____ Accepted, ____ accepted as noted, ____ not accepted, ____ received too late.

Reviewed by:

Architect Date

Construction Manager Date

District Date

END OF SECTION

SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: DSPTS MODULAR
- B. District's Name: Imperial Valley College
- C. Architect's Name: SGH Architects.
- D. Scope: It is the intent of this project to provide all the necessary site work construction noted on the drawings and specified for the installations of the Modular Office Building being provided at this site. It is the responsibility of this site-work contractor to coordinate their work with that of the Modular Building Manufacturer. Plans of the Modular Building Manufacturer is available for review at the Architects. Office.
 - 1. Work included will consist of but not be limited to:
 - a. Site clearing fill and pad compaction.
 - b. Relocate any valves, heads, or piping in order to maintain a fully operable irrigation system.
 - c. Removal of all excess grass and soil to an approved dump site.
 - d. Coordination with the modular building manufacturer to assure that site work interfaces with the installation of the modular building.
 - e. Site CMU walls, concrete walk, ramps and patch and repair of (e) sidewalks for utility trenching.
 - f. Installation of site electrical utility service and connection to modular building including ground system.
 - g. Installation and connection of Data, I.T., Telecom, Fire Alarm & Security, including all interior building components.
 - h. Installation and connection of all utilities to modular building (electrical, sewer, water)
 - i. Accessible signage at each exterior door.
 - 2. Work to be provided by Modular Building Manufacturer:
 - a. construction and installation of (1) Modular Office Building.
 - b. Concrete foundation, access vents, ventwell, mow curb, crawl space drainage.
 - c. Interior finish work in Modular Office Building.
 - d. Interior electrical I(power and lighting), plumbing work in modular office building.
 - e. Provide conduit for low voltage Data, I.T., Telecom, Fire Alarm & Security.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: Multiple prime contracts each based on a Stipulated Price as described in Owner-Contractor Agreement.

- B. The work of each separate prime contract is identified in this section and on Drawings.
- C. The Work: The Work is construction and related services for a , CBC, Occupancy Type Business Group B and Assembly Group A2, Construction Type III-A, totaling approximately 43,345 square feet.

1.03 CONTRACT DOCUMENTS

- A. Contract Requirements:
 - 1. Conditions of the Contract and other Contract documents have been included in the Project Manual, as indicated in the Table of Contents.
 - a. Such documents are not Specifications.
 - 2. Specifications are found in Divisions 1 through 32 of the Project Manual.
- B. Contract Drawings: The Drawings provided with and identified in the Project Manual are the Drawings referenced in the Agreement.
 - 1. The location, extent and configuration of the required construction and improvements are shown and noted on Drawings.
 - a. The Drawings are referenced in the Agreement.
 - b. An index of Drawings is included in the set of Drawings.
 - 2. Drawings are arranged into series according to design discipline. Such organization and all references to trades, subcontractor, specialty contractor or supplier shall not control the Contractor in dividing the Work among subcontractors or in establishing the extent of the Work to be performed by any trade.
 - 3. Where the terms "as shown", "as indicated", "as noted", "as detailed", "as scheduled", or terms of like meaning, are used in the Drawings or Specifications, it shall be understood that reference is being made to the Drawings referenced in the Agreement.
 - 4. Where reference to the word "plans" is made anywhere in Drawings, Specifications and related Contract Documents, it shall be understood to mean the Drawings referenced in the Agreement.
- C. Contract Specifications: The Specifications provided in the Project Manual are the Specifications referenced in the Agreement.
 - 1. Specifications are organized by Divisions and Sections in accordance with the recommended practices of the Construction Specifications Institute.
 - a. Such organization shall not control the Contractor in dividing the Work among subcontractors or in establishing the extent of Work to be performed by any trade.
 - 2. Specifications are included in the Project Manual, which may also include other Bidding and Contract Documents.
 - a. Contents of the Project Manual are listed in Document 00 01 10 - Table of Contents, in the Project Manual.

1.04 PERMITS, LICENSES AND FEES

- A. Permits:
 - 1. For Work included in the Contract, Contractor shall obtain all permits from authorities having jurisdiction and from serving utility companies and agencies.
 - 2. District will reimburse Contractor for amount charged for such permits, without mark-up.

3. For Work performed under design/build basis, plancheck and permit fees shall be included in the Contract Sum.
- B. Licenses:
1. Contractor shall obtain and pay all licenses associated with construction activities, such as business licenses, contractors' licenses and vehicle and equipment licenses.
 2. All costs for licenses shall be included in the Contract Sum.
- C. Assessments:
1. District will pay all assessments and utility service connection fees. Costs of assessments shall not be included in the Contract Sum.
- D. Test and Inspection Fees:
1. Contractor shall pay all fees charged by authorities having jurisdiction and from serving utility companies and agencies, for tests and inspections conducted by those authorities, companies and agencies.
 2. District will reimburse Contractor for actual amount of such fees, without mark-up.
 3. Refer to Section 01 40 00 - Quality Requirements for additional information on tests and inspections and responsibility for payment of fees.

1.05 OWNER OCCUPANCY

- A. District intends to continue to occupy adjacent portions of the existing site during the entire construction period.
- B. District intends to occupy the Project upon Substantial Completion.
- C. District intends to occupy a certain portion of the Project prior to the completion date for the conduct of normal operations.
- D. Cooperate with District to minimize conflict and to facilitate District's operations.
- E. Schedule the Work to accommodate District occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Arrange use of site and premises to allow:
 1. District occupancy.
 2. Work by Others.
 3. Work by District.
 4. Use of site and premises by the public.
- C. Provide access to and from site as required by law and by District:
 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 2. Site Access:
 - a. Limit access to site to indicated routes and access points as indicated.
 - b. If routes and access points are not indicated, access shall be as approved by District.
 - c. Do not restrict access to adjacent properties and do not restrict access for those

performing work under separate contracts for the District.

3. Do not obstruct roadways, sidewalks, or other public ways without permit.
4. Construction Limit:
 - a. Limit construction activities to areas indicated on Drawings as Project Area or, if not indicated, to areas within the parcel as described in the legal description on the Drawings.
 - b. Refer also to Section 01 50 00 - Temporary Construction Facilities and Controls for additional requirements.
- D. Existing building spaces may not be used for storage.
- E. Time Restrictions:
 1. Limit conduct of especially noisy, malodorous, and dusty exterior work to the hours of 7 AM to 6 PM.
- F. Utility Outages and Shutdown:
 1. Limit disruption of utility services to hours the site is unoccupied.
 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to District and authorities having jurisdiction.
 3. Prevent accidental disruption of utility services to other facilities.

1.07 CONSTRUCTION WASTE MANAGEMENT

- A. Construction and waste management, complying with Section 01 74 19 - Construction Waste Management and Disposal, is a requirement for this project.
- B. The Contractor, Prime Contractors, and subcontractors all have obligations in meeting the requirements of this specification.

1.08 SPECIFICATION SECTIONS APPLICABLE TO ALL CONTRACTS

- A. Unless otherwise noted, all provisions of the sections listed below apply to all contracts. Specific items of work listed under individual contract descriptions constitute exceptions.
- B. Section 01 20 00 - Price and Payment Procedures.
- C. Section 01 30 00 - Administrative Requirements.
- D. Section 01 31 14 - Facility Services Coordination.
- E. Section 01 32 16 - Construction Progress Schedule.
- F. Section 01 35 53 - Security Procedures.
- G. Section 01 40 00 - Quality Requirements.
- H. Section 01 42 19 - Reference Standards.
- I. Section 01 50 00 - Temporary Facilities and Controls.
- J. Section 01 51 00 - Temporary Utilities.
- K. Section 01 52 13 - Field Offices and Sheds.
- L. Section 01 55 00 - Vehicular Access and Parking.
- M. Section 01 58 13 - Temporary Project Signage.
- N. Section 01 60 00 - Product Requirements.

- O. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- P. Section 01 70 00 - Execution and Closeout Requirements.
- Q. Section 01 78 00 - Closeout Submittals.

END OF SECTION

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

- A. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

- A. Use Schedule of Values Form:
 - 1. Form provided by District.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date established in Notice to Proceed.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- F. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- G. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- H. Revise schedule to list approved Change Orders, with each Application For Payment.
 - 1. List each authorized Change Order as an extension on the continuation sheet, listing the Change Order number and dollar value as for an original portion of Work.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
 - 1. Substantiating information will normally be required only for those portions of Work whose completion state cannot be readily determined by observation of the completed Work.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Balance to Finish.
 - 9. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
 - 1. No Change Orders shall be included with Application for Payment until approved in writing by District and Architect. Also approved by DSA when appropriate.
- I. Submit one electronic and three hard-copies of each Application for Payment.
- J. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01 33 00.
 - 2. Construction progress schedule, revised and current as specified in Section 01 33 00.
 - 3. Current construction photographs specified in Section 01 33 00.
 - 4. Partial release of liens from major subcontractors and vendors.
 - a. Provide with each Application for Payment lien releases from all subcontractors, workers and materials suppliers employed for the Project covering their portion of Work to date for which payment application is made. Lien release forms will be provided by District and shall be completed in accordance with directions provided.
 - 5. Project record documents as specified in Section 01 78 00, for review by District which will be returned to the Contractor.
 - 6. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 ADDENDA

- A. Addenda are changes issued prior to the signing of the Contract for Construction. These Addenda shall be signed by the Architect and approved by the Division of the State Architect.
- B. These documents may or may not have approved by the Division of the State Architect prior to the close of Bid.
 - 1. If not approved by DSA prior to close of the bidding period, the contract price shall include the Addenda.
 - 2. No work shall proceed regarding any Addendum until approved by DSA.
 - 3. Revisions to Addenda, when approved by DSA, shall be incorporated by an additional addendum or Change Order as indicated below and as provided for in the Contract for Construction and General Conditions.

1.06 MODIFICATION PROCEDURES

- A. Construction Changes, General:
 - 1. The following describe administrative procedures to be followed in compliance with provisions of the Conditions of the Contract for Architect's Supplemental Instructions, Construction Change Directives, Construction Change Documents, and Contract Change Orders.
 - 2. The Architect will prepare and issue a Bulletin on which the Architect's Supplemental Instructions, a Construction Change Directive or a Request for Proposal will be presented to the Contractor for action.
- B. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- C. Contract Change Order Forms: Form as directed by District.
- D. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
 - 1. Architect's Supplemental Instructions:
 - a. Minor changes in the Work, not involving an adjustment in either the Contract Sum or Contract Time, as authorized by the Conditions of the Contract, will be presented by the Architect using the Architect's Bulletin form.
 - b. Should the Architect's Supplemental Instructions result in disputed costs and time adjustments, such dispute shall be resolved in accordance with the provisions of the Conditions of the Contract.
- E. For other required changes, not involving structural, accessibility, or fire-life-safety portions of approved Drawings and Specifications, Architect will issue a document signed by District instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.

3. DSA Construction Change Document approval for substitutions and changes to structural, accessibility, or fire-life-safety portions of approved Drawings and Specifications is required from DSA prior to fabrication and installation. CAC Section 4-215, 4-233(c), & 4-338(c).
 - a. The approved Construction Change Document shall be signed by:
 - 1) Architect of Record.
 - 2) When applicable:
 - (a) Structural Engineer of Record.
 - (b) Mechanical Engineer of Record.
 - (c) Electrical Engineer of Record.
 - (d) Delegated Professional Engineer.
 - 3) Division of the State Architect for final approval.
4. Construction Change Directives: In accordance with provisions of the Conditions of the Contract, the District may direct the Contractor to proceed with a change in the Work prior to formal preparation, review and agreement of a Contract Change Order, in order to not delay construction.
 - a. The Architect will prepare and issue a change document containing a Construction Change Directive which, when signed by the District and the Architect, shall instruct the Contractor to proceed with a change in the Work, for subsequent inclusion in a Contract Change Order.
 - b. Should the Construction Change Directive result in disputed costs and time adjustments, such dispute shall be resolved in accordance with the provisions of the Conditions of the Contract.
 - c. Construction Change Directives shall follow procedures specified below for Contract Change Orders except that Contractor shall immediately proceed with the change upon receipt of the signed Change Directive.
- F. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 days.
 1. Such Request for Proposal may include an estimate of additions or deductions in Contract Time and Contract Sum for executing the change and may include stipulations regarding overtime work and the period of time the requested response from the Contractor shall be considered valid.
- G. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00.
 1. After review of the request and with the District's approval, the Architect will prepare a change document containing a Request for Proposal, as described above.
 2. Issuance of such a request by the Architect shall not indicate authorization of the Contractor to proceed with the proposed change.

3. Changes will be approved only by an approved Construction Change Directive and Contract Change Order.
- H. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- I. Substantiation of Costs: Provide full information required for evaluation.
1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
 - a. Cost and Time Resolution: If amounts for changes in Contract Sum and Contract Time cannot be agreed upon by District and Contractor, amounts shall be resolved in accordance with provisions of the Conditions of the Contract for resolution of disputes and the following:
 - 1) Contractor shall keep accurate records of time, both labor and calendar days, and cost of materials and equipment.
 - 2) Contractor shall prepare and submit an itemized account and supporting data after completion of changed Work, within the time limits indicated in the Conditions of the Contract.
 - 3) Contractor shall provide full information as required and requested, for District and Architect to evaluate and substantiate proposed costs and time for the change in the Work.

- 4) When District and Contractor determine mutually acceptable amounts for changes in Contract Sum and Contract Time, a Contract Change Order shall be executed for these amounts.
 - 5) District shall have the right to audit Contractor's invoices and bid quotations to substantiate costs for Contract Change Orders.
- J. Construction Changes Based on Stipulated Sum or Time: Based on the Contractor's response to a Request for Proposal or Construction Change Directive, the District and Architect will review the response.
1. The District and Contractor shall negotiate a mutually acceptable adjustment in Contract Sum and Contract Time, as appropriate, prior to performance of the changed Work.
 2. A Contract Change Order for the stipulated amounts shall be prepared based on the stipulated sum and change in time.
- K. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
1. When agreement is reached on changes, if any, in the Contract Time and the Contract Sum, the Contractor shall prepare a Contract Change Order using a form as directed by the District, with supplementary documents as necessary to describe the change and the associated costs and schedule impacts.
 2. Construction Change Document approval is required from DSA prior to fabrication and installation.
 3. Submit Contract Change Orders to District through the Architect.
 4. Contractor shall prepare and submit five original sets of documents for each Change Order. District, Architect and Construction Manager shall sign the Change Order indicating acceptance and approval of the change.
 - a. Structural Engineer shall also sign the Change Order, when applicable.
 5. All Change Orders must be approved by DSA prior to fabrication and installation.
 6. Upon approval of the Change Order, Contractor shall promptly execute the change in the Work.
- L. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- M. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
1. Contractor shall submit revised schedules at the next Application for Payment following approval and acceptance of the Contract Change Order.
- N. Promptly enter changes in Project Record Documents.

1.07 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:

1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Division 00 - Procurement and Contracting Requirements: Restrictions on timing of substitution requests.
- B. Section 00 43 25 - Substitution Request Form - During Procurement: Required form for substitution requests made prior to award of contract (During procurement).
- C. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.
- D. Section 01 33 00 – Submittal Procedures
- E. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
- F. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Requests by Contractor to deviate from specified requirements for products, materials, equipment, and methods, or to provide products other than those specified, shall be considered requests for substitutions except under the following conditions:
 - 1. Substitutions are requested during the bidding period, and accepted prior to execution of the Contract. Acceptance shall be in the form of written Addendum to the Bidding

documents or revision to the Drawings or Specifications for use as Construction Contract Documents.

2. Changes in products, materials, equipment, and methods of construction are directed by the District or Architect.
 3. Contractor options for provision of products and construction methods are specifically stated in the Contract Documents.
 4. Change in products, materials, equipment, and methods of construction is required for compliance with Codes, ordinances, regulations, orders and standards of authorities having jurisdiction.
- B. Substitution Provisions: Refer to substitution provisions of the Conditions of the Contract, in addition to the requirements specified herein. Provisions for consideration and acceptance of substitutions shall be as follows:
1. Documentation:
 - a. Substitutions will not be considered if they are indicated or implied on shop drawing, product data or sample submittals.
 - b. All requests for substitution shall be made by separate written request from Contractor.
 2. Cost and Time Considerations: Substitutions will not be considered unless a net reduction in Contract Sum or Contract Time results to the District's benefit, including redesign costs, life cycle costs, changes in related Work and overall performance of building systems.
 3. Design Revision:
 - a. Substitutions will not be considered if acceptance will require substantial revision of the Contract Documents or will substantially change the intent of the design, in the opinion of the Architect.
 - b. The intent of the design shall include functional performance and aesthetic qualities.
 4. Data: It shall be the responsibility of the Contractor to provide adequate data demonstrating the merits of the proposed substitution, including cost data and information regarding changes in related Work.
 5. Determination by Architect:
 - a. Architect will determine the acceptability of proposed substitutions and will notify Contractor, in writing within a reasonable time, of acceptance or rejection.
 - b. The determination by the Architect regarding functional performance and aesthetic quality shall be final.
 6. Non-Acceptance: If a proposed substitution is not accepted, provide the specified product.
 - a. If, in the opinion of the Architect, the substitution request is incomplete or has insufficient data to enable a full and thorough review of the intended substitution, the substitution may be summarily refused and determined to be unacceptable.
 7. Substitution Limitation: Only one request for substitution will be considered for each product.

- C. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - a. Include a signed certification that the Contractor has:
 - 1) Reviewed the proposed substitution and has determined that the substitution is equivalent or superior in every respect to product requirements indicated or product specified in the Contract Documents.
 - 2) Certify the proposed substitution is suited for and can perform the purpose or application of the specified product indicated or specified in the Contract Documents.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to District.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - a. Include a signed waiver by the Contractor for changes in the Contract Time or Contract Sum because of the following:
 - 1) Substitution failed to perform adequately.
 - 2) Substitution required changes in on other elements of the Work.
 - 3) Substitution caused problems in interfacing with other elements of the Work.
 - 4) Substitution was determined to be unacceptable by authorities having jurisdiction.
 - 6. Agrees to reimburse District and Architect for review or redesign services associated with re-approval by authorities.
- D. A Substitution Request for specified installer constitutes a representation that the submitter:
 - 1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- F. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. Forms indicated and included in the Project Manual are adequate for this purpose, and must be used.
 - 2. No specific form is required. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.

- 2) District's, Architect's, and Contractor's names.
 - b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Indication of whether the substitution is for cause or convenience.
 - 3) Issue date.
 - 4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - 5) Description of Substitution.
 - 6) Reason why the specified item cannot be provided.
 - 7) Differences between proposed substitution and specified item.
 - 8) Description of how proposed substitution affects other parts of work.
 - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.
 - 4) Visual effect.
 - 5) Sustainable design features.
 - 6) Warranties.
 - 7) Other salient features and requirements.
 - 8) Include, as appropriate or requested, the following types of documentation:
 - (a) Product Data:
 - (b) Samples.
 - (c) Certificates, test, reports or similar qualification data.
 - (d) Drawings, when required to show impact on adjacent construction elements.
 - 9) Include a detailed description, in written or graphic form as appropriate, indicating all changes or modifications needed to other elements of the Work and to construction to be performed by the District and by others under separate Contract with District, that will be necessary if the proposed substitution is accepted.
 - d. Impact of Substitution:
 - 1) Savings to District for accepting substitution.
 - (a) Include detailed cost data, including a proposal for the net change, if any, in the Contract Sum.
 - 2) Change to Contract Time due to accepting substitution.
 - (a) Indicate the substitution's effect on the Construction Schedule. Indicate the effect of the proposed substitution on overall Contract Time and, as applicable, on completion of portions of the Work for use by District or for work under separate contract by District.
- G. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.
- B. Pursuant to Section 3400 of the Public Contract Code, requests for substitution will be considered only if received up to 7 days prior to the bid date. Subsequent requests will be considered only in the case of product unavailability, through no fault of the Contractor , or for reasons of cost reducing value analysis requested by the District .
- C. Submittal Form (before award of contract):
 - 1. Submit substitution requests by completing the form in Section 00 43 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. After Contract award, requests will be considered for cause only; in the case of product unavailability, through no fault of the Contractor , or for reasons of cost reducing value analysis requested by the District.
 - 1. Substitutions will be considered when a product, through no fault of the Contractor, becomes unavailable or unsuitable due to regulatory change.
 - 2. Product Availability Waiver:
 - a. Failure to place orders for specified products sufficiently in advance of required date for incorporation into the Work will not be considered as a valid reason for which Contractor may request a substitution or deviation from requirements of the Drawings and Specifications.
 - 3. Waiver: At the discretion of the District, limitations on substitutions may be waived.
- C. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the District through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 - 3. Bear the costs engendered by proposed substitution of:
 - a. District's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

- b. Other construction by District.
 - c. Other unanticipated project considerations.
- E. Substitutions will not be considered under one or more of the following circumstances:
- 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 2. Without a separate written request.
 - 3. When acceptance will require revisions to Contract Documents.

3.04 CONTRACT DOCUMENT REVISIONS:

- A. Should a Contractor-proposed substitution or alternative sequence or method of construction require revision of the Contract Drawings or Specifications;
 - 1. Including revisions for the purposes of determining feasibility, scope or cost, or revisions for the purpose of obtaining review and approval by authorities having jurisdiction.
 - 2. Revisions will be made by Architect or other consultant of District who is the responsible design professional, as approved in advance by District.
- B. Services of Architect or other consultant of the District, including time spent in researching and reporting on proposed substitutions or alternative sequence and method of construction, shall be paid by Contractor when such activities are considered additional services to the design services contracts of the Architect or other responsible design professional with the District.
- C. Costs of services by Architect or other responsible design professional of the District shall be paid on a time and materials basis, based on current hourly fee schedules, with reproduction, long distance telephone and shipping costs reimbursable at cost plus usual and customary mark-up for handling and billing.
- D. Such fees shall be paid whether or not the proposed substitution or alternative sequence or method of construction is ultimately accepted by District and a Change Order is executed.
- E. Such fees shall be paid from Contractor's portion of savings, if a net reduction in Contract Sum results. If fees exceed Contractor's portion of net reduction, Contractor shall pay all remaining fees unless otherwise agreed in advance by the District.
- F. Such fees owed shall be deducted from the amount owed Contractor on the Application for Payment next made following completion of revised Contract Drawings and Specifications or completion of research and other services. District will then pay Architect or other consultant of the District.
- G. Certain substitutions require approval from DSA.

3.05 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
 - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.06 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

3.08 ATTACHMENTS

- A. A facsimile of the Substitution Request Form (During Construction) required to be used on the Project is included after this section.

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Contractor's daily reports.
- H. Progress photographs.
- I. Coordination drawings.
- J. Submittals for review, information, and project closeout.
- K. Number of copies of submittals.
- L. Requests for Interpretation or Information (RFI) procedures.
- M. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 32 16 - Construction Progress Schedule: Form, content, and administration of schedules.
- B. Section 01 60 00 - Product Requirements: General product requirements.
- C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- D. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.
- E. Technical Product Sections: Procedures for specific submittals specified in those Sections to be made at Contract closeout.

1.03 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires responsive action by Construction Manager and Architect or other responsible design professional.
- B. Informational Submittals: Written information that does not require responsive action by Construction Manager and Architect or other responsible design professional.
- C. Unsolicited Submittals: Action or informational submittals not required by the Contract Documents or not requested by the reviewer. Unsolicited submittals may be returned with notation "not reviewed."

- D. Product Data: Standard published information ("catalog cuts") and specially prepared data for the Work of the Contract, including standard illustrations, schedules, brochures, diagrams, performance charts, instructions and other information to illustrate a portion of the Work.
- E. Request for Interpretation or Information (RFI): A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as an RFI.
- F. Samples: Physical examples that demonstrate the materials, finishes, features, workmanship and other characteristics of a portion of the Work. Accepted samples shall serve as quality basis for evaluating the Work.
- G. Shop Drawings, Product Data and Samples: Instruments prepared and submitted by Contractor, for Contractor's benefit, to communicate to Architect the Contractor's understanding of the design intent, for review and comment by Architect on the conformance of the submitted information to the general intent of the design. Shop drawings, product data and samples are not Contract Documents.
- H. Shop Drawings: Drawings, diagrams, schedules and illustrations, with related notes, specially prepared for the Work of the Contract, to illustrate a portion of the Work.
- I. Other Submittals: Technical data, test reports, calculations, surveys, certifications, special warranties and guarantees, operation and maintenance data, extra stock and other submitted information and products shall not be considered as Contract Documents but shall be information from Contractor to Architect to illustrate a portion of the Work for confirmation of understanding of design intent.

1.04 PROJECT COORDINATOR

- A. Project Coordinator: Construction Manager.
- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for material delivery access, traffic, and parking facilities.
 - 1. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 10 00 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- G. Make the following types of submittals to Architect through the Project Coordinator:
 - 1. Requests for Interpretation or Information.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.

5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation or Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 2. Contractor and Architect are required to use this service.
 3. It is Contractor's responsibility to submit documents in allowable format.
 4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 6. Unless specifically requested, paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
- C. Submittal Service: The selected service is:
 1. Bluebeam Software Inc.; Bluebeam Revu Studio: www.bluebeam.com.
 2. Other Service acceptable to both District and Architect.
 - a. Direct email with PDF copies.

- D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
 - 1. Representatives of District are scheduled and included in this training.
- E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for District.

3.02 PRECONSTRUCTION MEETING

- A. District will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. District.
 - 2. Architect.
 - 3. Contractor.
- C. Agenda:
 - 1. Execution of District-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Submission of initial Submittal schedule.
 - 6. Designation of personnel representing the parties to Contract and Architect.
 - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 8. Scheduling.
 - 9. Scheduling activities of a Geotechnical Engineer.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, District, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

- A. Schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
 - 1. Contractor.
 - 2. District.
 - 3. Architect.
 - 4. Contractor's superintendent.
 - 5. Major subcontractors.
 - 6. Inspector of Record.
- C. Agenda:
 - 1. Distribute and discuss list of subcontractors and suppliers.

2. Project Communication Procedures: Review requirements and administrative requirements for written and oral communications.
 - a. Review requirements and administrative procedures Contractor may wish to institute for identification and reporting purposes.
3. Change Procedures: Review requirements and administrative procedures for Change Orders, Construction Change Directives, Architect's supplemental instructions and Contractor's Requests for Interpretation or Information.
4. Use of premises by District and Contractor.
 - a. Site access restrictions, if any, and requirements to avoid disruption of operations at adjoining facilities or operations.
 - b. Construction Facilities and Temporary Utilities: Designate storage and staging areas, construction office areas; review temporary utility provisions; present District's requirements for use of premises.
5. District's requirements.
6. Construction facilities and controls provided by District.
7. Temporary utilities provided by District.
8. Survey and building layout.
9. Security and housekeeping procedures.
10. Schedules.
 - a. Distribute and discuss initial construction schedule and critical work sequencing of major elements of Work;
 - b. Include coordination of District Furnished / Contractor Installed (OFCl) products;
11. Application for payment procedures.
12. Procedures for testing.
13. Procedures for maintaining record documents.
14. Requirements for start-up of equipment.
15. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, District, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-weekly intervals.
- B. Meeting Time and Location: As mutually agreed by District, Architect, and Contractor, at on-site location.
- C. Special Meetings: As necessary, Construction Manager may convene special meetings to discuss specific construction issues in detail and to plan specific activities.
 1. See Section 01 70 00 - Execution and Closeout Requirements.
- D. Attendance Required:
 1. Contractor.

2. District.
 3. Architect.
 4. Contractor's superintendent.
 5. Major subcontractors.
- E. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Review of off-site fabrication and delivery schedules.
 8. Maintenance of progress schedule.
 9. Corrective measures to regain projected schedules.
 - a. Develop corrective measures and procedures, including but not necessarily limited to additional personnel loading to regain planned schedule.
 10. Planned progress during succeeding work period.
 11. Coordination of projected progress.
 12. Maintenance of quality and work standards.
 13. Effect of proposed changes on progress schedule and coordination.
 14. Other business relating to work.
- F. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, District, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

- A. Contractor's Review: All schedules shall be reviewed and approved by Contractor prior to submission for Architect's and Construction Manager's review.
- B. Reviews by Architect and Construction Manager will be to ascertain the general status of construction and shall not be interpreted to establish or approve the means, methods, techniques and sequences of construction.

3.06 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. In addition to transmitting electronically a copy to District and Architect, submit two printed copies at weekly intervals.
 1. Submit in format acceptable to District.
 2. Submit using required form, a sample of which is appended to this section.

- C. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
1. Date.
 2. High and low temperatures, and general weather conditions.
 3. List of subcontractors at Project site.
 4. List of separate contractors at Project site.
 5. Approximate count of personnel at Project site.
 - a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
 6. Major equipment at Project site.
 7. Material deliveries.
 8. Safety, environmental, or industrial relations incidents.
 9. Meetings and significant decisions.
 10. Unusual events (submit a separate special report).
 11. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
 15. Change Orders received and implemented.
 16. Testing and/or inspections performed.
 17. List of verbal instruction given by District and/or Architect.
 18. Signature of Contractor's authorized representative.

3.07 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
- C. Photography Type: Digital; electronic files.
- D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- E. In addition to periodic, recurring views, take photographs of each of the following events:
 1. Completion of site clearing.
 2. Excavations in progress.
 3. Foundations in progress and upon completion.
 4. Structural framing in progress and upon completion.

5. Final completion, minimum of ten (10) photos.
- F. Take photographs as evidence of existing project conditions as follows:
 1. Interior views: each elevation, floor and ceilings prior to demolition.
 2. Exterior views: each elevation, roof and areas adjacent to construction limits.
- G. Views:
 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
 2. Consult with Architect for instructions on views required.
 3. Provide factual presentation.
 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
 5. Point of View Sketch: Provide sketch identifying point of view of each photograph.
- H. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 1. Delivery Medium: Via email.
 2. File Naming: Include project identification, date and time of view, and view identification.
 3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
 4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
 5. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.08 COORDINATION DRAWINGS

- A. See Section 01 31 14 - Facility Services Coordination.
- B. Provide information required by Project Coordinator for preparation of coordination drawings.
- C. Review drawings prior to submission to Architect.

3.09 REQUESTS FOR INTERPRETATION OR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in the Contract Documents.
 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare in a format and with content acceptable to District.
 - a. Use the form provided in this project manual.
 - b. Use CSI/CSC Form 13.2A - Request for Interpretation.
 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 - a. Submit RFIs from subcontractors and material suppliers through, be reviewed by and be attached to an RFI prepared, signed and submitted by Contractor.
 - 1) RFIs from subcontractors and material suppliers are to be:
 - (a) Reviewed by Contractor.
 - (b) Corrected and rewritten to clarify as required by Contractor.
 - (c) Placed on the proper form, then signed, and submitted by Contractor.
 - (d) RFIs submitted directly by subcontractors or material suppliers will be returned unanswered to the Contractor.
 - 2) RFIs submitted directly by subcontractors or material suppliers will be returned unanswered to the Contractor.
 - b. Review all subcontractor- and supplier-initiated RFIs and take actions to resolve issues of coordination, sequencing and layout of the Work.
 - 1) RFIs submitted to request clarification of issues related to means, methods, techniques and sequences of construction or for establishing trade jurisdictions and scopes of subcontracts will be returned without response.
 - (a) Such issues are solely the Contractor's responsibility.
 - 2) Contractor is responsible for delays resulting from the necessity to resubmit an RFI due to insufficient or incorrect information presented in the RFI.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The District reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. District's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 - a. Inability to determine from the Contract Documents the exact material, process, or system to be installed;
 - b. Or when the elements of construction are required to occupy the same space (interference);
 - c. Or when an item of Work is described differently at more than one place in the Contract Documents.
 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
 - a. In all cases, furnish all information required for the Architect to analyze and/or understand the circumstances causing the RFI and prepare a clarification or direction as to proceed for RFIs issued to request clarification of issues related to:
 - 1) Means, methods, techniques and sequences of construction, for example
 - 2) Pipe and duct routing, clearances;
 - 3) Specific locations of Work shown diagrammatically;
 - 4) Apparent interferences and similar items.
 - 5) If information included with this type RFI by the Contractor is insufficient, the RFI will be returned unanswered.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
 - 3. Highlight items requiring priority or expedited response.
 - 4. Highlight items for which a timely response has not been received to date.
 - 5. Identify and include improper or frivolous RFIs.
- H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to District.
 - 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 - 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 - 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 - 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.10 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 - 1. Submit at the same time as the preliminary schedule.
 - a. Submit initial Submittals Schedule within 14 days of date of Notice of Award of construction.
 - b. After review and return by Architect, resubmit Submittals Schedule within 10 days and thereafter submit updated Submittals Schedules at each Construction Progress Meeting.
 - c. Submit one copy each to Owner and Architect.
 - 2. Coordinate with Contractor's construction schedule and schedule of values.
 - 3. Format schedule to allow tracking of status of submittals throughout duration of construction.
 - a. Prepare schedules in Gantt format using software at Contractor's option, providing clear indication of sequencing and scheduling of Work, for determination of "critical path" of construction progress.

- 1) Submittals shall be connected to the related construction element by a graphically indicated critical path on the same page.
- 2) Present schedules using opaque reproductions on substantial paper, with sheet size a multiple of 8-1/2 by 11 inches and large enough to clearly read characters.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

3.11 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.12 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for District.

3.13 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:

1. Project record documents.
 2. Operation and maintenance data.
 - a. Include operation and maintenance data submittals in Submittals Schedule specified above.
 - b. Provide space for review action stamps and, if required by governing authorities having jurisdiction, license seal of design Professional, if applicable.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for District's benefit during and after project completion.

3.14 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format with renderable text; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Small Size Sheets, Not Larger Than 11 by 17 inch: Submit one copy; the Contractor shall make his own copies from original returned by the Architect after making his own file copy.
- C. Extra Copies at Project Closeout: See Section 01 78 00.
- D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 1. After review, produce duplicates.
 2. Retained samples will not be returned to Contractor unless specifically so stated.
 3. Quantity:
 - a. Submit minimum of four (4) samples of each of color, texture and pattern.
 - b. Submit one item only of actual assembly or product.
 - c. Unless otherwise noted, full-size and complete samples will be returned and may be incorporated into field mock-ups and the Work.

3.15 SUBMITTAL PROCEDURES

- A. General Requirements:
 1. Use a separate transmittal for each item.
 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 3. Transmit using approved form.
 4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - a. For example:
 - 1) 09 21 16-1 - First submittal for Section 09 21 16 - Gypsum Board Assemblies.

- 2) 09 21 16-2 - Second submittal for Section 09 21 16 - Gypsum Board Assemblies.
- b. Use same number for resubmittals as original submittal, followed by a letter indicating sequential resubmittal. For example:
 - 1) 09 21 16-2A - Resubmission of second submittal for Section 09 21 16 - Gypsum Board Assemblies.
 - 2) 09 21 16-2B - Second resubmission of second submittal for Section 09 21 16 - Gypsum Board Assemblies.
6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - b. Field measurements have been determined and verified.
 - c. Conformance with requirements of Contract Drawings and Specifications is confirmed.
 - d. Catalog numbers and similar data are correct.
 - e. Work being performed by various subcontractors and trades is coordinated.
 - f. Field construction criteria have been verified, including confirmation that information submitted has been coordinated with the work being performed by others for District and actual site conditions.
 - g. All deviations from requirements of Drawings and Specifications have been identified and noted.
7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Send submittals in electronic format via email to Architect.
 - b. Upload submittals in electronic form to Electronic Document Submittal Service website.
8. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, District, or another affected party, allow an additional 7 days.
9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - a. Changes in the Work shall not be authorized by submittals review actions.
 - b. No review action, implicit or explicit, shall be interpreted to authorized changes in the Work.
 - c. Changes shall only be authorized by separate written Contract Change Order or Construction Change Directive, in accordance with the Conditions of the Contract and Section 01 20 00 - Price and Payment Procedures.
10. Provide space for Contractor and Architect review stamps.
11. When revised for resubmission, identify all changes made since previous submission.

12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 14. Submittals not requested will be recognized, but will be returned without comment,
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Use of reproductions of the Contract Documents in digital data form to create shop drawings is only permitted as defined in Division 01 and individual product sections.
 3. Coordination: Show all field dimensions and relationships to adjacent or critical features of Work.
 4. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Samples will be reviewed for aesthetic, color, or finish selection.
 3. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 4. Color Selection Samples: Architect will review and select colors for Project only after all colors are received, so that colors may be properly coordinated.
 5. Copies: Submit actual samples. Photographic or printed reproductions will not be accepted.
 6. Review of Field Samples: Review by Architect of field samples will be made for the following example products, as applicable, if not otherwise required and if requested by Contractor.
 - a. Concrete wall finishes and detailing (edges, corners and reveals).
 - b. Concrete paving colors and textures.
 - c. Gypsum board textures and finishes.
 - d. Field-applied paint colors and finishes.

3.16 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
 - 1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
 - 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 - 1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
 - 2) Non-responsive resubmittals may be rejected.
 - 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - 2) Non-responsive resubmittals may be rejected.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
 - 1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 - 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

**SECTION 01 30 00.01
REQUEST FOR INTERPRETATION**

RFI NUMBER: _____

DATE: _____

PROJECT NAME: Imperial Valley College – DSPTS MODULAR **PROJECT NO.:** 19-43100-00

TO: SGH ARCHITECTS

707 Brookside Avenue, Redlands, California 92373

Attention: _____

Contractor: _____

Address: _____

BRIEF SUMMARY OF RFI: _____

Drawing No. _____ Detail No. _____

Specification Section _____ Title _____

Page _____ Paragraph _____

DETAILS OF THIS RFI: _____

SUGGESTED SOLUTION: _____

Response required by: _____ (min. 3 full days) Submitted By: _____

Organization: _____

RESPONSE: _____

Attachments: _____

Response By: _____ Date: _____

Organization: _____

Copies: __ File __ District __ Structural __ Mechanical __ Plumbing __ Electrical

END OF RFI

SECTION 01 31 14
FACILITY SERVICES COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Services of a coordinator for facility services construction.
- B. Coordination documents.
 - 1. BIM Coordination drawings for the various trades of this project.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Responsibilities of separate contractors.
 - 1. Various types of Work to be coordinated, including Owner-Furnished / Contractor-Installed products.
- B. Section 01 30 00 - Administrative Requirements: Additional requirements for coordination.
- C. Section 01 60 00 - Product Requirements: Spare parts and maintenance materials.
 - 1. Coordination of products, especially general requirements for system completeness and product substitutions.
- D. Section 01 70 00 - Execution and Closeout Requirements: Starting of Systems. Systems Demonstration.
- E. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 MECHANICAL AND ELECTRICAL COORDINATOR

- A. Employ and pay for services of a person, technically qualified and administratively experienced in field coordination of the type of work required to be coordinated, for the duration of the Work.
 - 1. This designated individual may serve a dual role on the project team.

1.04 SUBMITTALS

- A. Submit name, address, and telephone number of coordinator and name of principal officer for review.
- B. Submit coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 COORDINATION REQUIRED

- A. Coordinate the Work as stated in the Conditions of the Contract.
 - 1. Coordinate Work under the Contract with work under separate contracts by District.

2. Preinstallation Meetings: Coordinate and document work between trades. See Section 01 70 00 - Execution and Closeout Requirements.
 3. Cooperate with District, Construction Manager, and others as directed by District in scheduling and sequencing the incorporation into the Work of Owner Furnished / Contractor Installed (OFCI) products identified in the Contract Drawings and Specifications.
- B. Relationship of Documents:
1. Drawings, Specifications and other Contract Documents in the Project Manual are intended to be complementary.
 2. What is required by one shall be as if required by all.
 3. What is shown or required, or may be reasonably inferred to be required, or which is usually and customarily provided for similar work, shall be included in the Work.
- C. Discrepancies:
1. Error, omission, ambiguity or conflict in Drawings or Specifications shall be brought to Architect's attention during the bidding period, for Architect's determination and direction in accordance with provisions of the Conditions of the Contract.
- D. Construction Interfacing and Coordination: Layout, scheduling and sequencing of Work shall be solely the Contractor's responsibility.
1. Contractor shall verify, confirm and coordinate field measurements so that new construction correctly and accurately interfaces with conditions existing prior to construction.
- E. Contractor shall bring together the various parts, components, systems and assemblies as required for the correct interfacing and interpretation of all elements of the Work.
1. All work required to provide complete and fully operational systems shall be included in the contract price.
 2. Contractor shall coordinate Work to correctly and accurately connect abutting, adjoining, overlapping and related elements, including work under separate contracts by District, utility agencies and companies.
- F. Coordinate the work listed below:
1. Structural: Division 03, Division 04, Division 05, and Division 06.
 2. Architectural: Division 7, Division 9.
 3. Specialties: Division 10.
 4. Heating, Ventilating, and Air Conditioning: Division 23.
 5. Electrical: Division 26.
- G. Coordinate progress schedules, including dates for submittals and for delivery of products.
- H. Conduct meetings among subcontractors and others concerned, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.
- I. Participate in progress meetings. Report on progress of work to be adjusted under coordination requirements, and any required changes in schedules. Transmit minutes of meetings and reports to concerned parties.

- J. Coordination of subcontracts and separate contracts
 - 1. Superintendence of Work:
 - a. Contractor shall appoint a field superintendent and a project manager, who shall directly and full time supervise and coordinate all Work of the Contract.
 - 2. Subcontractors, Trades and Materials Suppliers:
 - a. Require all subcontractors, trades, crafts and suppliers to coordinate their portions of Work with the Contractor's field superintendent to prevent scheduling, sequencing, dimensional and other conflicts and omissions.
 - 3. Coordination with Work Under Separate Contracts:
 - a. Coordinate and schedule Work under the Contract with work being performed for Project under separate contracts by District, serving utilities and public agencies.
 - b. Make and facilitate direct contacts with parties responsible for work of the Project under separate contracts, in order to provide timely notifications and to facilitate information exchanges.

3.02 COORDINATION DOCUMENTS

- A. Prepare coordination drawings to organize installation of products for efficient use of available space, for proper sequence of installation, and to identify potential conflicts.
 - 1. Produce BIM Drawings for the proposed installation and the placement of pipes, conduits, other materials, and the locations, size and reinforcement of penetrations in the building structure to conform to the structural Drawing and Specifications.
 - 2. Structural requirements take precedence when the requirements of the Mechanical, Electrical or other items are in conflict with structural.
 - 3. Take all precautions prior to coring into an existing building structure.
 - 4. Notify the structural engineer and obtain written approval prior to completing any structural penetrations if the structural integrity of an existing or new building structure may be compromised. Refer to Section 01 70 00 - Execution and Closeout Requirements for cutting and patching.
 - 5. Review limitations in available space for installation or service.
 - a. Overlay plans of each trade and verify space requirements and conflicts between trades.
 - b. Minor changes and adjustments that do not affect design intent may be made by Contractor and highlighted for Architect's review prior to purchase and installation.
 - 6. Incompatibility between items provided under different trades.
 - 7. Inconsistencies between drawings, specifications and codes (between trades and within each trade).
- B. Prepare a master schedule identifying responsibilities for activities that directly relate to this work, including submittals and temporary utilities; organize by specification section.
- C. Verify that utility, and other building system requirement characteristics of operating equipment are compatible with provided utilities, and other building systems.
 - 1. Coordinate work of various trades having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

- D. Identify electrical power characteristics and control wiring required for each item of equipment.
- E. Maintain documents for the duration of the work, recording changes due to site instructions, modifications or adjustments.
- F. After Architect review of original and revised documents, reproduce and distribute copies to concerned parties.

3.03 COORDINATION DRAWINGS / BIM MODEL

- A. Building Information Modeling (BIM) is required for this Project, such as 3-D Clash Coordination. Submit a BIM Project Execution Plan for Program Project Manager and Design Professional review. The plan shall at minimum include the following items.
 - 1. Project Goals/ BIM uses and Objectives: Clear objective and goals. Align objectives with Construction Documents and Agreement.
 - 2. Project Information: Provide key project contacts including project name, contract type, delivery method, project description, project schedule, phases, and milestones.
 - a. Key Project Contacts:
 - 1) Project Managers.
 - 2) BIM Manager.
 - 3) Trade BIM Managers.
 - 4) Superintendents and other major project roles.
 - b. BIM and Trade BIM Managers must have at least two years of BIM experience of similar size projects.
 - c. Organizational Roles and Staffing: Define roles in each organization and specific responsibilities.
 - 3. BIM Information Exchanges:
 - a. Identify the information exchanges created as part of the planning process in the BIM Project Execution Plan.
 - b. Information exchanges are to illustrate the model elements by discipline, level of detail, and any specific attributes important to the project.
 - 4. Collaboration Procedures:
 - a. Develop Team electronic and activity collaboration procedures.
 - b. Includes model management and standard meeting actions and agendas.
 - 5. Quality Control: Project teams should determine and document their overall strategy for quality control of the model.
 - 6. Model Structure: The team must identify the methods to ensure model accuracy and comprehensiveness.
 - 7. Project Deliverables: Identify project deliverables as required by Construction Manager.
 - 8. Field Execution of final BIM product: Outline how the final BIM deliverables will be executed to reduce construction errors, change orders, and trade scheduling issues.

3.04 COORDINATION OF SUBMITTALS

- A. Review shop drawings, product data, and samples for compliance with Contract Documents and for coordination with related work. Transmit copies of reviewed documents to Architect.
- B. Check field dimensions and clearances and relationship to available space and anchors.
- C. Check compatibility with equipment and work of other sections, electrical characteristics, and operational control requirements.
- D. Check motor voltages and control characteristics.
- E. Coordinate controls, interlocks, wiring of switches, and relays.
- F. Coordinate wiring and control diagrams.
- G. When changes in the work are made, review their effect on other work.
- H. Verify information and coordinate maintenance of record documents.

3.05 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

- A. Review proposals and requests for substitution prior to submission to Architect.
- B. Verify compliance with Contract Documents and for compatibility with work of other sections.
- C. Submit with recommendation for action.

3.06 OBSERVATION OF WORK

- A. Observe work for compliance with Contract Documents.
- B. Maintain a list of observed deficiencies and defects; promptly submit.

3.07 DOCUMENTATION

- A. Observe and maintain a record of tests. Record:
 - 1. Specification section number and product name.
 - 2. Name of Contractor, subcontractor, and special inspector.
 - 3. Name of testing agency and name of inspector.
 - 4. Name of manufacturer's representative present.
 - 5. Date, time, and duration of tests.
 - 6. Type of test, and results.
 - 7. Retesting required.
- B. Assemble background documentation for dispute and claim settlement.
- C. Submit copies of documentation to Architect upon request.

3.08 EQUIPMENT START-UP

- A. Verify utilities, connections, and controls are complete and equipment is in operable condition as required by Section 01 70 00.
- B. Observe start-up and adjustments, test run, record time and date of start-up, and results.
- C. Observe equipment demonstrations made to District; record times and additional information required for operation and maintenance manuals.

3.09 INSPECTION AND ACCEPTANCE OF EQUIPMENT

- A. Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.
- B. Assist Architect with review. Prepare list of items to be completed and corrected.

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Responsibilities of individual Multi-Prime Contractors to coordinate with the Construction Manager's Master Project Schedule.
- B. Preliminary schedule.
- C. Construction progress schedule, with network analysis diagrams and reports.
- D. Summary schedule.
- E. Weekly/Short term (Look Ahead) Schedule.

1.02 RELATED SECTIONS

- A. Section 01 10 00 - Summary: Work sequence.
- B. Section 01 30 00 - Administrative Requirements: Submittal Schedule.

1.03 REFERENCE STANDARDS

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.
- B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2015.

1.04 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. Submit two copies to Construction Manager and one copy to Architect.
- C. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- D. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- E. Within 10 days after joint review, submit complete schedule.
- F. Submit updated schedule with each Application for Payment.
 - 1. Revise schedule also upon issuance of Change Orders and Construction Change Directives which substantially affect construction sequence or schedule.
- G. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
- H. Submit under transmittal letter form specified in Section 01 30 00 - Administrative Requirements.

1.05 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one year's minimum experience in scheduling construction work of a complexity comparable

to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1. Designate the Scheduler in writing and within ten (10) workdays after Notice of Intent to Award, as the qualified responsible person for preparation, maintenance, updating, and revision of all schedules for the full term of construction.
 2. Scheduler:
 - a. Dedicated to this project and available on-site as needed to meet the strict requirement of this spec. section.
 - b. All scheduling software and hardware located on-site.
 - c. Scheduler will attend all project meetings called for as specified in Section 01 30 00.
 3. Qualifications of responsible person:
 - a. Knowledge of critical path method (CPM) scheduling utilizing Primavera P6 latest release software.
 4. References:
 - a. Submit written reference of three (3) project Owners who have personal experience with this scheduler on previous projects.
 - b. Identify name, address, telephone number, project name, and cost.
 5. Construction Manager reserves the right to disapprove Scheduler when submitted by Contractor based on his/or her sole discretion. Construction Manager reserves the right to remove Scheduler from the project without cause.
- B. Contractor's Administrative Personnel: Three years minimum experience in using and monitoring CPM schedules on comparable projects.
- C. Reviews by Architect and Construction Manager: Reviews by Architect and Construction Manager will be to ascertain the general status of construction and shall not be interpreted to establish or approve the means, methods, techniques and sequences of construction.
- D. Contractor's Review: All schedules shall be reviewed and approved by Contractor prior to submission for Architect's and Construction Manager's review.
- E. Changes and Deviations: Identify all deviations from requirements of Drawings and Specifications.
1. Changes in the Work shall not be authorized by submittals review actions.
 2. No review action, implicit or explicit, shall be interpreted to authorized changes in the Work.
 3. Changes shall only be authorized by separate written Change Order or Field Change Directive, in accordance with the Conditions of the Contract.

1.06 SCHEDULE FORMAT

- A. Format: Prepare schedules in format at Contractor's option, either bar chart, PERT or GANTT format, providing clear indication of sequencing and scheduling of Work, for determination of "critical path" of construction progress.
1. Prepare schedules in MS Project or Primavera.
 2. Provide clear indication of sequencing and scheduling of work for determination of "critical path" of construction progress.

3. Present schedule in both electronic and reproducible paper formats with sheet size large enough to clearly read the characters.
- B. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- C. Diagram Sheet Size: Maximum 22 x 17 inches.
- D. Sheet Size: Multiples of 8-1/2 x 11 inches.
- E. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.
- B. Prescheduling Conference:
 1. Construction Manager will conduct a conference within fifteen (15) work days after the Notice of Intent to Award to comply with requirements in Section 01 30 00 - Administrative Requirements.
 - a. Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1) Review software limitations and content and format for reports.
 - 2) Verify availability of qualified personnel needed to develop and update schedule.
 - 3) Discuss constraints, including phasing work stages area separations interim milestones and partial District occupancy.
 - 4) Review delivery dates for District-furnished products.
 - 5) Review schedule for work of District's separate contracts.
 - 6) Review submittal requirements and procedures.
 - 7) Review time required for review of submittals and resubmittals.
 - 8) Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9) Review District's IT requirements for installation of their Work.
 - 10) Review time required for Project closeout and District startup procedures, including commissioning activities for MEP, Security Electronics Equipment.
 - 11) Review and finalize list of construction activities to be included in schedule.
 - 12) Review procedures for updating schedule.
- C. At the meeting, the Construction Manager will review scheduling requirements. These include schedule preparation, reporting requirements, labor and equipment loading, updates, revisions, and schedule delay analysis.
 1. The Contractor will present schedule methodology, planned sequence of operations, resource loading methodology, and proposed activity coding structure.
- D. Coding structure:

1. Submit proposed coding structure, identifying the code fields and the associated code values it intends to use in the project schedule.
2. A minimum, include code fields for Project Segment or Phase, Area of Work, Type of Work, Submittal/Procurement/Construction and Responsibility/Subcontractor.
 - a. Refer to NETWORK DETAILS AND GRAPHICAL OUTPUT for listing of activity categories to be included in the schedule.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
 1. Identify Work of separate buildings, phases, units or other logically grouped activities to facilitate review of Application for Payment with completed Work.
- D. Provide sub-schedules for each stage of Work identified in Section 01 10 00 - Summary.
- E. Provide sub-schedules to define critical portions of the entire schedule.
- F. Include conferences and meetings in schedule.
- G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- H. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
 1. Format: Prepare Submittals Schedule in a format comparable to Construction Progress Schedule, specified in Article above.
 2. Content: List all items specified to be submitted, indicating submittal number (see instructions specified in Section 01 30 00 - Administrative Requirements, submittal type (i.e., product data, shop drawings, sample, quality control report, maintenance and operating data, etcetera), scheduled date submittal is to be made and date review should be complete in order to maintain construction on schedule.
 3. The Contractor shall submit to the Architect a schedule of the shop drawings that lists their required submission and approval dates.
 - a. Allow minimum one (1) week for the Architect to review the submittals. Some submittals may require a longer review period. See Section 01 30 00 - Administrative Requirements.
 - b. Allow for the possibility that the consultant team will request revisions and resubmittal following the initial submittal.
 - c. The schedule shall encompass the entire construction period and will be revised by the Contractor and reviewed by the project team at each project meeting.
 4. Changes and Deviations: Identify all deviations from requirements of Drawings and Specifications.
 - a. Changes in the Work shall not be authorized by submittals review actions.

- b. No review action, implicit or explicit, shall be interpreted to authorized changes in the Work.
 - c. Changes shall only be authorized by separate written Change Order or Construction Change Directive, in accordance with the Conditions of the Contract and Section 01 20 00 - Price and Payment Procedures.
- 5. Administration: Review of Submittals Schedules by Architect, Construction Manager, and District will be to ascertain the general status of submittals review and shall not be interpreted to establish or approve the means, methods, techniques and sequences of construction.
 - a. Submit one copy each to Construction Manager and Architect.
 - b. Submit initial Submittals Schedule within 14 days of construction start date established in Notice to Proceed.
 - c. After review, resubmit Submittals Schedule within 10 days and thereafter submit updated Submittals Schedules at each Construction Progress Meeting.
- I. Indicate delivery dates for owner-furnished products.
- J. Coordinate content with schedule of values specified in Section 01 20 00 - Price and Payment Procedures.
 - 1. Include Submittals Schedule.
- K. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 NETWORK ANALYSIS

- A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.
- B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.
- C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
 - 1. Preceding and following event numbers.
 - 2. Activity description.
 - 3. Estimated duration of activity, in maximum 15 day intervals.
 - 4. Project Milestones; include "Project Start" and "End Project" Millstones.
 - a. Schedule starts no earlier than the Project Duration (Day 1) will start on the Notice To Proceed (NTP) date.
 - 5. Earliest start date.
 - 6. Earliest finish date.
 - 7. Actual start date.

- a. "Project Start" Milestone to have no predecessors and "End Project" Milestone has no successors.
 - b. "Project Start": Constrained by a "Mandatory Start" Milestone.
 - c. "End Project": Constrained by a "Mandatory Finish" Milestone.
 - d. No other activities on the schedule may have constraints, unless reviewed and approved by Construction Manager and Architect.
8. Actual finish date.
 9. Latest start date.
 10. Latest finish date.
 11. Total and free float; float time shall accrue to District and to District's benefit.
 - a. Contractor does not own the float.
 - b. "Float time" refers to the time between earliest finish date and the latest finish date of each activity shown on the Construction Schedule.
 - c. Any float time indicated in the Construction Schedules required by this Section are to be held jointly by the District and Contractor.
 - d. Any delay (including District caused) encountered is to be subtracted from the available days ahead of progress against the Construction Schedule.
 - 1) District may claim float days equal to the delay until such float days are exhausted.
 - 2) No compensation of any type will be due the Contractor until the delay extends the overall project substantial completion date.
 - e. Weather (Rain) day requirements are as specified in the "Construction Services Agreement."
 12. Monetary value of activity, keyed to Schedule of Values.
 13. Percentage of activity completed.
 14. Responsibility.
- D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.
- E. Required Reports: List activities in sorts or groups:
1. By preceding work item or event number from lowest to highest.
 2. By amount of float, then in order of early start.

3.05 CREW SCHEDULES

- A. Separate and concurrent with the Baseline Schedule, submit a schedule histogram depicting crew loading for Contractor's own labor forces and those of each subcontractor. Submit this crew schedule electronically.
- B. Provide the breakdown of a typical crew, by trade, for resource loading quantification.

3.06 WEATHER DAYS ALLOWANCE- AS ANTICIPATED BY THE CONTRACTOR

- A. Based on historical weather in the local area, the Baseline Schedule shall include all non-work days on which the Contractor anticipates Work will not be performed due to adverse weather days that are anticipated to occur within the work day calendar and impact critical activities.

- B. The Contractor shall not receive any additional compensation for unavoidable delays due to inclement or unsuitable weather, and no time extension to complete any Contractual Completion Events as defined in General Conditions, will be considered due to inclement or unsuitable weather or conditions resulting there from.

3.07 REVIEW AND EVALUATION OF SCHEDULE

- A. Review all schedules reviewed and approved by Contractor prior to submission for review by Architect and District.
- B. Participate in joint review and evaluation of schedule with Construction Manager and Architect at each submittal.
- C. Evaluate project status to determine work behind schedule and work ahead of schedule.
- D. After review, revise as necessary as result of review, and resubmit within 10 days.
- E. Review by Architect and District will be to ascertain the general status of construction and shall not be interpreted to establish or approve the means, methods, techniques and sequences of construction.

3.08 SUMMARY SCHEDULE

- A. Provide Summary Schedule, upon request, which consolidates groups of activities associated with Major Items of Work shown on Baseline Schedule.
 - 1. Summary Schedule is intended to give an overall indication of the project schedule without a large amount of detail.
 - 2. This schedule shall include the current status of each of the contract Milestones listed in the Agreement, and any significant activities that are critical to the completion of the Milestone work at the required time.
- B. Include in the Summary Schedule a separate Gantt Chart depicting only the critical path of the project at the time of the update.
- C. Updated and submitted monthly and with each Schedule Update or Schedule Revision.

3.09 WEEKLY (SHORT TERM LOOK-AHEAD) SCHEDULE

- A. Submit to Construction Manager, twenty four (24) hours prior to each weekly progress meeting, a short term look ahead schedule showing the activities completed during the previous week and the schedule of activities for the following 4 weeks.
- B. Using the same computer software as the progress schedule, use the Activity ID's, Descriptions, and logic of the current progress schedule when producing a Weekly Schedule in CPM schedule or a bar chart format.
 - 1. In the event that the Weekly Schedule no longer conforms to the current schedule, Contractor may be required to revise either or both schedule(s).
- C. The activity designations used in the Weekly Schedule must be consistent with those used in the Baseline Schedule and the monthly Schedule Updates.
- D. Contractor and Construction Manager must agree on the format of the Weekly Schedule.
- E. Weekly Schedule should indicate locations of work, critical activities, early start and early finish dates, actual start and actual finish dates, progress, and remaining durations for each activity in the three-week schedule.

3.10 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.11 ADJUSTMENT OF CONTRACT TIMES

- A. Subject to the terms of General Conditions, contract time will be adjusted only for causes specified as generally described below.
 - 1. Non-excusable delay:
 - a. Includes actions or inactions of the Contractor, or events for which the Contractor has assumed contractual responsibility that would independently delay the completion of the Work beyond the current Contract completion date.
 - 1) This also includes actions or inactions of subcontractors, suppliers, or material manufacturers at any tier.
 - b. No time extensions will be granted for non-excusable delays.
 - 2. Excusable delay:
 - a. Events which are unforeseeable, outside the control of, and without the fault or negligence of either the District or the Contractor (or any party for whom either is responsible), which would independently delay the completion of the Work beyond the current Contract completion date.
 - b. The Contractor is entitled to a time extension only.
 - c. No other damages will be approved.
 - 3. Compensable delay:
 - a. Actions or inactions of the District, or events for which the District has assumed contractual responsibility, which would independently delay the completion of the Work beyond the current Contract completion date.
 - b. The Contractor is entitled to a time extension and delay damages.
 - 4. Concurrent delay:
 - a. Any combination of the above three (3) types of delay occurring on the same calendar date, or cases where the combination consists of two (2) or more instances of the same type of delay occurring on the same calendar date.
 - 1) Exception to concurrent delay:
 - (a) When one cause of delay is District-caused or caused by an event which is beyond the control and without the fault or negligence of either the

District or the Contractor and the other Contractor-caused, the Contractor is entitled only to a time extension and no delay damages.

- B. If the Contractor believes that the District has impacted its work, such that the project completion date will be delayed, the Contractor must submit proof demonstrating the delay to the critical path.
 - 1. Proof, in the form of a Time Impact Analysis, may entitle the Contractor to an adjustment of Contract Time.
- C. Notify Construction Manager of a potential request for Contract Time adjustment within five (5) days of the start of the impact.
- D. The Contractor shall prepare and submit along with any Change Order Request (COR), response to Request for Proposal/Quote (RFP/RFQ), Differing Site Condition (DSC) notification or Request for Additional Compensation (RAC) a Time Impact Analysis (TIA) which includes both a written narrative and a schedule diagram depicting how the changed work may affect the progress of work and other schedule activities.
 - 1. The schedule diagram shall show how the Contractor proposes to incorporate the changed work in the schedule, and how it impacts the current updated schedule and critical path.
 - 2. The TIA shall not be resource constrained, or leveled using resource limits.
 - 3. Failure to include a TIA with the COR, Proposal, Quote, DSC or RAC shall constitute a waiver of the right to later claim any adjustment in time based upon changed or unforeseen Work.
- E. Time Impact Analysis (TIA):
 - 1. Use the accepted schedule update that is current relative to the time frame of the delay event (change order, third party delay, or other District-caused delay). Represent the delay event in the schedule by:
 - a. Inserting new activities associated with the delay event into the schedule.
 - b. Revising activity logic.
 - c. Revising activity durations.
 - 2. If the project schedule's critical path and milestone date(s) are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact without resource constraints may be warranted.
 - 3. The Time Impact Analysis submittal must include the following information:
 - a. A fragment of the portion of the schedule affected by the delay event.
 - b. A narrative explanation of the delay issue and how it impacted the schedule.
 - c. A digital file containing the schedule file used to perform the Time Impact Analysis.
- F. When a delay to the project as a whole can be avoided by revising preferential sequencing or logic, and the Contractor chooses not to implement the revisions, the Contractor will be entitled to a time extension and no compensation for extended overhead.
- G. Indicate clearly that the Contractor has used, in full, all project float available for the work involved in the request, including any float that may exist between the Contractor's planned completion date and the Contract completion date.

1. Utilize the latest version of the Schedule Update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the Contract Time.
- H. Adjustment of the Contract Times will be granted only when the Contract Float has been fully utilized and only when the revised date of completion of the Work has been pushed beyond the Contract completion date.
 1. Adjustment of the Contract Times will be made only for the number of days that the planned completion of the work has been extended.
- I. Actual delays in activities which do not affect the critical path work or which do not move the Contractor's planned completion date beyond the Contract completion date will not be the basis for an adjustment to the Contract Time.
- J. Submit request as specified with Contract Documents.
 1. In cases where the Contractor does not submit a request for Contract Time adjustment for a specific change order, delay, or Contractor request within the specified period of time, then it is mutually agreed that the particular change order, delay, or Contractor request has no time impact on the Contract completion date and no time extension is required.
- K. The Construction Manager will, within five (5) working days after receipt of a Contract Time adjustment, request any supporting evidence, review the facts, and advise the Contractor in writing.
 1. Include the new Progress Schedule data, if accepted by the District, in the next monthly Schedule Update.
 2. When the District has not yet made a final determination as to the adjustment of the Contract Time, and the parties are unable to agree as to the amount of the adjustment to be reflected in the Progress Schedule, reflect that amount of time adjustment in the Progress Schedule as the Construction Manager may accept as appropriate for such interim purpose.
 - a. It is understood and agreed that any such interim acceptance by the Construction Manager shall not be binding.
 - b. Interim acceptance shall be made only for the purpose of continuing to schedule the Work
 - c. Interim acceptance shall remain until such time as a final determination as to any adjustment of the Contract Time acceptable to the Construction Manager has been made.
 - d. Revise the Progress Schedule prepared thereafter in accordance with the final decision.

3.12 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Construction Manager, Architect, District, and other concerned parties.
- B. Posting: Post one copy, minimum, of most recent Construction and Submittals Schedules in the Contractor's jobsite office, readily available to Construction Manager and Architect.

- C. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.
- D. Archive: Preserve a minimum of two copies of all superseded schedules, with a minimum of one copy available at job office for review by Construction Manager or Architect.

3.13 FINAL SCHEDULE SUBMITTAL

- A. The final Schedule Update becomes the As-Built Schedule.
 - 1. The As-Built Schedule reflects the exact manner in which the project was constructed by reflecting actual logic, start and completion dates for all activities accomplished on the project.
 - 2. Contractor's Project Manager and Scheduler sign and certify the As-Built Schedule as being an accurate record of the way the project was actually constructed.
- B. Retainage will not be released until final Schedule Update is provided.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Submittal Procedures
- B. Shop Drawings
- C. Product Data
- D. Samples
- E. Manufacturers' Instructions
- F. Manufacturers' Certificates
- G. Coordinated Drawings

1.2 SUBMITTAL PROCEDURES

- A. Transmit separate request for each submittal directly to the General Contractor.
 - 1. Bind submittals sturdily, neatly label covers.
 - 2. Include Architect job number as it appears on Contract Documents.
 - 3. Include state agency application or approval number.
- B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphabetic suffix.
- C. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.
 - 1. Provide name and telephone number of individuals who may be contacted for further information.
- D. Apply Contractor's dated stamp with Contractor's original signature or initials affixed thereto, certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Stamped signatures or initials are not acceptable.
- E. Schedule submittals to expedite the Project. Coordinate submission of related items.
 - 1. Make all submittals in accordance with the progress schedule and far enough in advance of scheduled dates of installation to provide required time for reviews for securing necessary approvals for possible revision and resubmittal and for placing orders and securing delivery.
- F. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- G. State effect of substitution on construction schedule, and changes required in other work or products.
- H. Provide space for Contractor and Architect review stamps.
- I. Revise and resubmit submittals as required, identify all changes made since previous submittal.
- J. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

- K. Determine and verify all field dimensions and conditions, materials, catalog numbers and similar data.
- L. Coordinate as required with all trades and all public agencies involved.
- M. Unless otherwise specifically authorized by Architect, make all submittals in groups containing all associated items. Architect may reject partial submittals as not complying with the provisions of this section.

1.3 SHOP DRAWINGS

- A. Submit a schedule of the shop drawings, listing their required submission and review dates to the Architect for review and acceptance. The schedule shall allow sufficient time for checking by the Architect. In addition, the shop drawing submission and review dates shall be incorporated into the progress schedule required in the General Conditions.
- B. Submit newly prepared information, drawn to accurate scale. Highlight, encircle or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project will not be approved as Shop Drawings.
- C. Shop Drawings shall include fabrications and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
 - 1. Dimensions
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
- D. Sheet Size: Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 inch x 11 inch, but not larger than 30 inch x 42 inch.
- E. The Contractor shall review, stamp with his approval as herein required, and submit with reasonable promptness and in orderly sequence, in accordance with the submittal schedule, all shop drawings required by the Contract Documents or subsequently by the Architect as covered by modifications. Shop drawings shall be properly identified. At the time of submission, the Contractor shall inform the Architect in writing of any deviation in the shop drawings from the requirements of the Contract Documents.
- F. Stamp: Each page of shop drawings shall bear the Contractor's stamp, which shall signify the Contractor's representation that he has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained in the shop drawings. Each stamp shall be accompanied by a wet signature or initial of an employee of the Contractor who may be contacted for information. Stamped signatures or initials are not acceptable.
- G. Method of Review: Make initial submittal of two blue-line prints and one sepia transparency of the shop drawings. Comments or corrections will be noted on the transparency and returned to the Contractor, who shall identify all changes made since the previous submittal and resubmit in the same manner. When reviewed, the transparency will be stamped and returned to the Contractor who shall make distribution of copies as required.
- H. The Architect will review shop drawings with reasonable promptness so as not to cause any

delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. The Architect's favorable review of a separate item shall not indicate acceptance of an assembly in which the item functions.

- I. Submittal of shop drawings to the Architect shall be made by the Contractor with a dated transmittal form or letter, and not by subcontractors or suppliers.
- J. The Architect's review of shop drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the Architect in writing of such deviation at the time of submission and the Architect has given written acceptance to the specific deviation, nor shall the Architect's favorable review relieve the Contractor from responsibility for errors or omissions in the shop drawings.
- K. No portion of work requiring shop drawings shall be commenced until the shop drawings have been returned with a favorable review by the Architect.

1.4 PRODUCT DATA

- A. Submit six (6) copies. One (1) copy will be retained by the Architect.
- B. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- C. After review, distribute and provide copies for Record Documents.

1.5 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of the Product with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Submit samples of finishes from the full range of manufacturers' standard colors, textures and patterns for Architect selection, or in custom colors selected.
- C. Include identification on each sample with full Project information.
- D. Submit a minimum of six (6) samples or as specified in individual sections of the specifications, three of which will be retained by the Architect.
- E. Reviewed samples which may be used in the Work are indicated in individual specification Sections.
- F. Selection or rejection of samples will be made by the Architect in writing.

1.6 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing in quantities specified for Product Data.
- B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.7 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification Sections, submit manufacturers' certificate to Architect for review in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product but must be

acceptable to Architect.

1.8 COORDINATED DRAWINGS

- A. Submit drawings which indicate routing, locations, sizes, types and numbers of components in concealed spaces where potential conflict may occur between structures, mechanical, electrical, fire sprinklers, communications and ceiling suspension systems.
- B. Indicate locations of all ceiling penetrations and surface-mounted items. Provide cross sections at all areas to indicate proper support of ceilings and non-interference with work of other sections of the specifications. Cross sections shall indicate coordination required and proposed solutions for routing of elements where potential conflict exists. Reproduction of Architect's reflected ceiling plan is not acceptable.
- C. Drawings shall be based on field measurements, shop drawings and product data.
- D. Conflicts shall be brought to Architect's attention immediately.
- E. Submit to the General Contractor, in writing, requests for clarification or interpretations that will affect the intent of the Contract Documents.
- F. The coordinated drawings shall indicate each class of work in the affected area. The drawing or written submittal shall include Contractor's recommendations for the solution of any potential conflicts as well as recommendations tendered by any work of any section of the specifications which may be affected thereby.
- G. Submit the coordinated drawings in a scale of not less than $1/8" = 1' - 0"$ with necessary sections and profiles at an appropriate, clearly readable enlarged scale. Submit the coordinated drawings as one reproducible and two blue-line prints.
- H. The Architect will review the submittals, make appropriate notations and comments to ensure the solution meets the intent of the Contract Documents and then return to Contractor for implementation.
- I. The Contractor shall be responsible for the proper coordination of the work of all sections of the specifications in the execution of coordinated drawing. Any installation of materials, components or equipment under one section of the specifications without full and complete, agreement, knowledge and consent by fabricators of adjacent or otherwise related or affected work will not be approved.
- J. It shall be incumbent upon the Contractor that all fabricators of work involved in the execution of coordinated drawings be informed, consulted and advised in sufficient advance time to arrive at solutions where no extension of contract time or extra cost to the Owner will be approved due to Contractor's negligence in the expeditious, timely submittal of coordinated drawings.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 01 35 50
REQUESTS FOR ELECTRONIC FILES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements to request electronic construction document files from Architect.
- B. Hold Harmless Agreement form.

1.02 RELATED SECTIONS

- A. Section 01 30 00 - Administrative Requirements: Shop Drawings, Product Data and Samples.
- B. Section 01 70 00 - Execution and Closeout Requirements.
- C. Divisions 31 through 32 - Site Work.

1.03 REQUIREMENTS

- A. Electronic files have legal ramifications as information therein can be modified.
- B. In order to receive this electronic information, the following Hold Harmless Agreement form must be executed in its entirety, including signature by a company officer.
- C. Costs for processing and handling electronic files, however limited, will be \$250.00

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION.)

PART 3 - EXECUTION

3.01 ELECTRONIC FILE TRANSFER PROCEDURE

- A. Submit a check in the amount of \$250.00 along with a list of the requested sheet numbers and an acknowledged copy of this waiver to the office of the Architect, SGH Architects, 707 Brookside Avenue, Redlands, California 92373.
- B. In order to expedite the transfer, upon receipt of a PDF copy of this acknowledgement, the requested CAD/Revit/BIM files will be sent in the form of a compact disc, DVD, or thumb drive to the recipient, as requested, by UPS, similar delivery service, or other method of electronic transfer after payment is received.
- C. It is expressly understood that any transfer is done as a courtesy and can be revoked at any time by the Architect.

HOLD HARMLESS AGREEMENT

ARCHITECT'S PROJECT: IMPERIAL VALLEY COLLEGE – DSPTS MODULAR

ARCHITECT'S PROJECT NUMBER: 19-43100-00

We, _____, understand that we may be receiving electronic media containing design information, not necessarily intended for construction. We agree to hold SGH Architects harmless for any defects in this data. We agree that it shall be our responsibility to reconcile this electronic data with the paper plans, and that only the paper plans shall be regarded as legal documents for the referenced project.

Further, the Contractor acknowledges that the Architect’s reports, drawings, specifications, field data, field notes, laboratory test data, calculations, estimates and other similar documents are instruments of professional service, not products. In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professionals, the Parties listed above covenant and agree that all such drawings and data are instruments of service of the Design Professionals, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Parties agree that in accepting and utilizing any drawings and other data, that the Design Professionals waive all responsibility for any subsequent use of these data, the accuracy of dimensions, and the interpretation of information contained herein.

The Parties further agree not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Parties further agree to waive all claims against the Design Professionals resulting in any way from any unauthorized changes of the drawings and data or any other use other than for the project which is the subject of this Agreement.

The Contractor shall indemnify, defend and hold harmless the Design Professionals and its subconsultants and their officers, agents, employees from any claims, damages, losses, liabilities or expenses (including attorneys’ fees) arising out of use of such documents without Consultant’s prior written authorization.

Under no circumstances shall transfer of the drawings and other data be deemed a sale by the Design Professionals, and the Design Professionals make no warranties, either express or implied of the merchantability and fitness of the data for any particular purpose.

Acknowledged by:

Signature of Company Officer Print or Type Name Date

Company Name

Street Address City, State, Zip Code

E-mail Address

END OF SECTION

SECTION 01 35 53
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including formal security program, entry control, personnel identification, guard service, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: use of premises and occupancy.
- B. Section 01 50 00 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

- A. Protect Work, existing premises and District's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program in coordination with District's existing security system at project mobilization.
- C. Maintain program throughout construction period until District acceptance precludes the need for Contractor security.

1.04 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.
- C. Maintain log of workers and visitors, make available to District on request.
- D. District will control entrance of persons and vehicles related to District's operations.
- E. Contractor shall control entrance of persons and vehicles related to District's operations.
- F. Coordinate access of District's personnel to site in coordination with District's security forces.

1.05 PERSONNEL IDENTIFICATION

- A. Shall be worn by Contractor's superintendent and all sub contractors
- B. Provide identification badge to each person authorized to enter premises.
- C. Badge To Include: Personal photograph, name, assigned number, expiration date and employer.
- D. Maintain a list of accredited persons, submit copy to District on request.
- E. Special badges shall be issued to construction personnel when term of construction exceeds six months.
- F. Require return of badges at expiration of their employment on the Work.

1.06 GUARD SERVICE

- A. Employ uniformed guard service to provide watch persons at site during all non-working hours.

- B. The phone number for security is _____.
- C. All personnel must obey and act immediately upon any request by security.
- D. In an emergency, from inside the facility, dial _____. Outside the facility, dial 911.

1.07 RESTRICTIONS

- A. Do not allow cameras on site or photographs taken except by written approval of District.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Contractor Quality assurance submittals.
- B. Quality assurance.
- C. Testing and inspection agencies and services.
- D. Contractor's construction-related professional design services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Manufacturers' field services.
- I. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 00 01 02 – Project Information
- B. Section 01 33 00 - Submittal Procedures.
- C. Section 01 42 19 - Reference Standards.
- D. Section 01 45 33 - Code Testing, Special Inspection and Procedures: Testing laboratory services and inspections required by Division of the State Architect (DSA), during the course of construction.
- E. Section 01 60 00 - Product Requirements: Requirements for material and product quality.
 - 1. Product options, substitutions, transportation and handling requirements, storage and protection requirements, and system completeness requirements.

1.03 REFERENCE STANDARDS

- A. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2017.

1.04 DEFINITIONS

- A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.

3. Temporary bracing.
4. Temporary falsework for support of spanning or arched structures.
5. Temporary stairs or steps required for construction access only.
6. Temporary hoist(s) and rigging.
7. Investigation of soil conditions to support construction equipment.

1.06 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for District's information.
 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Quality Control Submittals Schedule
 1. Schedule Format: Include quality control submittals on Submittals Schedule specified in accordance with General Conditions
 2. Schedule Content: List all tests, inspections and reports specified to be submitted, indicating submittal number, submittal type (field test, field inspection, fabrication inspection, etcetera), scheduled date of quality control activity and date report should be made.
- D. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for District's information.
 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 2. Include required product data and shop drawings.
 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- E. Test Reports: After each test/inspection, promptly submit two copies of report to Architect, DSA, and to Contractor.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.

- e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for District's information.
- F. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
- 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- G. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the District's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- H. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for District.
- 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- I. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for District.
- 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
 - 2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or District.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
- 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

3. Qualification Statement: Provide documentation showing testing laboratory is approved by Division of the State Architect.
 4. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in California.
- C. Contractor's Quality Control (CQC) Plan:
1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - 1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - 1) Management and control of documents and records relating to quality.
 - 2) Communications.
 - 3) Coordination procedures.
 - 4) Resource management.
 - 5) Process control.
 - 6) Inspection and testing procedures and scheduling.
 - 7) Control of noncomplying work.
 - 8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
 - 9) Control of testing and measuring equipment.
 - 10) Project materials certification.
 - 11) Managerial continuity and flexibility.
 - c. District will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
 - d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. District's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. District reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.
- D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.08 REFERENCES AND STANDARDS - SEE SECTION 01 42 19

1.09 REGULATORY REQUIREMENTS FOR TESTING AND INSPECTION

- A. Inspections, testing and approvals as required by authorities having jurisdiction. Refer to Section 01 41 00 - Regulatory Requirements and Section 01 45 33 - Code-Required Special Inspections and Procedures.
- B. Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Unless more stringent requirements are indicated or specified, comply with manufacturer's instructions and recommendations, reference standards and building code research report requirements in preparing, fabricating, erecting, installing, applying, connecting and finishing Work.
- C. Deviations from Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Document and explain all deviations from reference standards and building code research report requirements and manufacturer's product installation instructions and recommendations, including acknowledgement by the manufacturer that such deviations are acceptable and appropriate for the Project.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. District will employ and pay for services of an independent testing agency approved by DSA to perform other specified testing.
- B. As indicated in individual specification sections, District or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Contractor Employed Agency:
 - 1. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 2. Laboratory: Authorized to operate in California.
 - 3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTRACTOR'S QUALITY ASSURANCE

- A. Quality Requirements: Work shall be accomplished in accordance with quality requirements of the Drawings and Specifications, including, by reference, all Codes, laws, rules, regulations and standards. When no quality basis is prescribed, the quality shall be in accordance with the best accepted practices of the construction industry for the locale of the Project, for projects of this type.

- B. Quality Control Personnel: Contractor shall employ and assign knowledgeable and skilled personnel as necessary to perform quality control functions to ensure that the Work is provided as required.

3.02 CONTROL OF INSTALLATION

- A. Quality of Products: Unless otherwise indicated or specified, all products shall be new, free of defects and fit for the intended use.
- B. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- C. Comply with manufacturers' instructions, including each step in sequence.
- D. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- E. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- F. Have work performed by persons qualified to produce required and specified quality.
- G. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- H. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.
- I. Quality of Installation: All Work shall be produced plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements.
- J. Protection of Existing and Completed Work: Take all measures necessary to preserve and protect existing and completed Work free from damage, deterioration, soiling and staining, until Acceptance by the District.
- K. Verification of Quality: Work shall be subject to verification of quality by District, or Architect in accordance with provisions of the General Conditions of the Contract.
 - 1. Contractor shall cooperate by making Work available for inspection by District, Architect or their designated representatives.
 - 2. Such verification may include mill, plant, shop, or field inspection as required.
 - 3. Provide access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated.
 - 4. Provide all information and assistance as required, including that by and from subcontractors, installers, fabricators, materials suppliers and manufacturers, for verification of quality by District, or Architect.
 - 5. Contract modifications, if any, resulting from such verification activities shall be governed by applicable provisions in the General Conditions.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with District's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

- 7. Inspections and Tests by Authorities Having Jurisdiction:
 - a. Contractor shall cause all tests and inspections to be made for Work under this Contract, as required by Building Departments, Department of Public Works, Fire Department, Health Department and similar agencies having jurisdiction.
 - b. Excepted as specifically noted, scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.
- 8. Inspections and Tests by Serving Utilities:
 - a. Contractor shall cause all tests and inspections required by serving utilities to be made for Work under this Contract.
 - b. Scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
 - 1. Observer subject to approval of Architect.
 - 2. Observer subject to approval of District.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 FIELD QUALITY CONTROL SUBMITTALS

- A. Administration: Make all submittals to the Architect, unless otherwise directed.
- B. Submittal Identification: Identify each submittal by Specification Section number followed by a number indicating sequential submittal for that Section. Coordinate submittal numbers with submittals specified in Section 01 30 00 - Administrative Requirements.
 - 1. Resubmittals shall use same number as original submittal, followed by a letter indicating sequential resubmittal.

03 30 00 - 1	First submittal for Section 03 30 00 - Cast in Place Concrete.
03 30 00 - 2	Second submittal for Section 03 30 00 - Cast in Place Concrete.
03 30 00 - 2A	Resubmittal of second submittal for Section 03 30 00 - Cast in Place Concrete.
03 30 00 - 2B	Second resubmittal of second submittal for Section 03 30 00 - Cast in Place Concrete.

- C. Project Identification: Title each submittal with Project name, submittal date and Architect's Project number.
- D. Copies: Provide PDF copies electronically transmitted or submit 6 copies, minimum, of reports of quality control reports on dry-process xerographic copies only.
- E. Contractor's Review:
 - 1. Submittals shall be made in accordance with requirements specified herein and in individual Sections.
 - 2. Indicate clearly on each submittal the specified or referenced values for each quality control activity and the values obtained.
 - 3. Note clearly and sign each submittal certifying that reported quality control activity "Conforms" or "Does Not Conform".
- F. Changes and Deviations:
 - 1. Identify all deviations from requirements of Drawings and Specifications.
 - 2. Changes in the Work shall not be authorized by submittals review actions.
 - 3. No review action, implicit or explicit, shall be interpreted to authorized changes in the Work.
 - 4. Changes shall only be authorized by separate written Change Order or Construction Change Directive, in accordance with the General Conditions and 01 20 00 - Price and Payment Procedures.
- G. Record Submittals: When record submittals are specified, submit three copies or sets only. Record submittals will not be reviewed but will be retained for historical and maintenance purposes.
- H. Unsolicited Submittals: Unsolicited submittals will be returned unreviewed.

3.07 ARCHITECT'S REVIEW

- A. General:
 - 1. Submitted Report review by Architect and Architect's consultants shall be only for general conformance with the design concept and requirements based on the information presented.
 - 2. Neither Architect nor Architect's consultants shall verify submitted quality control data.
- B. Contract Requirements:
 - 1. Review by Architect and Architect's consultants shall not relieve the Contractor from compliance with requirements of the Drawings and Specifications.
 - 2. Changes shall only be authorized by separate written Change Order or Construction Change Directive, in accordance with the General Conditions and 01 20 00 - Price and Payment Procedures.
- C. Observations by Architect and Architect's Consultants: Periodic and occasional observations of Work in progress will be made by Architect and Architect's consultants as deemed necessary to review progress of Work and general conformance with design intent.

3.08 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements, at no change in Contract Sum or Contract Time..
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.
- C. Architect's Acceptance and Rejection of Work: Architect reserves the right to reject all Work not in conformance to the requirements of the Drawings and Specifications.
- D. Acceptance of Non-Conforming Work: Acceptance of non-conforming Work, without specific written acknowledgement and approval of the District, shall not relieve the Contractor of the obligation to correct such Work.
 - 1. Acceptance of structurally related non-conforming work shall be submitted to DSA for review and approval.
- E. Contract Adjustment for Non-conforming Work:
 - 1. Should Architect or District determine that it is not feasible or in District's interest to require non-conforming Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between District and Contractor.
 - 2. If equitable amount cannot be agreed upon, a Construction Change Directive will be issued and the amount in dispute resolved in accordance with applicable provisions of the General Conditions.
- F. Non-Responsibility for Non-Conforming Work: Architect and Architect's consultants disclaim any and all responsibility for Work produced not in conformance with the Drawings and Specifications.

END OF SECTION

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 AUTHORITY AND PRECEDENCE OF CODES, ORDINANCES AND STANDARDS

- A. Authority: All codes, ordinances and standards referenced in the Drawings and Specifications shall have the full force and effect as though printed in their entirety in the Specifications.
- B. Precedence:
 - 1. Where specified requirements differ from the requirements of applicable codes, ordinances and standards, the more stringent requirements take precedence.
 - 2. Where the Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, the Drawings and Specifications take precedence so long as such increase is legal.
 - 3. Where no requirements are identified in the Drawings or Specifications, comply with all requirements of applicable codes, ordinances and standards of authorities having jurisdiction.
- C. Applicable Codes, Laws and Ordinances: Refer also to Section 01 10 00 - Summary, regarding permits and licenses.
 - 1. Performance of the Work is be governed by all applicable laws, ordinances, rules and regulations of Federal, State and local governmental agencies and jurisdictions having authority over the Project, including accessibility requirements.
 - 2. Performance of the Work shall be accomplished in conformance with all rules and regulations of public utilities, utility districts and other agencies serving the development.
 - 3. Where such laws, ordinances, rules and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Sum, except where changes in laws, ordinances, rules and regulations occur subsequent to the execution date of the Agreement.
- D. Applicable Building Codes: References on the Drawings or in the Specifications to "code" or "building code" not otherwise identified shall mean the codes specified below, together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction having authority over the Project.
- E. Performance of the Work shall meet or exceed the minimum regulatory requirements applicable to this project are summarized in this section, as adopted by Division of the State Architect:
 - 2019 BUILDING STANDARDS ADMINISTRATIVE CODE, PART 1, TITLE 24 C.C.R.
 - 2019 CALIFORNIA BUILDING CODE (CBC), PART 2, TITLE 24 C.C.R.
 - 2019 CALIFORNIA ELECTRICAL CODE (CEC), PART 3, TITLE 24 C.C.R.
 - 2019 CALIFORNIA MECHANICAL CODE (CMC), PART 4, TITLE 24 C.C.R.
 - 2019 CALIFORNIA PLUMBING CODE (CPC), PART 5, TITLE 24 C.C.R.
 - 2019 CALIFORNIA ENERGY CODE (CEC),PART 6, TITLE 24 C.C.R.

- 2019 CALIFORNIA FIRE CODE, PART 9, TITLE 24 C.C.R.
- 2019 CALIFORNIA GREEN BUILDING STANDARDS CODE, PART 11, TITLE 24 C.C.R.
- 2019 CALIFORNIA REFERENCED STANDARDS, PART 12, TITLE 24 C.C.R.
- TITLE 19 C.C.R., PUBLIC SAFETY, STATE FIRE MARSHAL REGULATIONS
- 2016 ASME A17.1 SAFETY CODE FOR ELEVATORS AND ESCALATORS

F. Erosion and Sedimentation Control Regulations: .

1. California Codes and Regulations; Title 24, California Building Code, Parts 1 & 2.
2. State of California State Water Resources Control Board Regulations.
3. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition.

1.02 SUMMARY OF REFERENCE STANDARDS

- A. Regulatory requirements applicable to this project are the following:
- B. UL 300 - Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment; 2005 (R2010).
- C. 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services; Final Rule; Department of Justice; current edition.
- D. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice; current edition.
- E. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- F. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- G. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.

1.03 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements relating to referenced standards.

1.02 QUALITY ASSURANCE

- A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue specified in the individual specification sections, except where a specific date is established by applicable code.
- C. Obtain copies of standards when required by Contract Documents.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Date of Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

PART 2 CALIFORNIA DEPARTMENT OF GENERAL SERVICES, DIVISION OF THE STATE ARCHITECT

2.01 INTERPRETATION OF REGULATIONS

- A. Document IR A-5 - Acceptance of Products, Materials, and Evaluations Reports; Revised 1-27-17 .
- B. Current listings are on the DGS website:
<http://www.dgs.ca.gov/dsa/Resources/IRManual.aspx>.

PART 3 UNITED STATES GOVERNMENT AND RELATED AGENCIES DOCUMENTS

3.01 CFR -- CODE OF FEDERAL REGULATIONS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content; Current Edition.
- C. AGC (CPSM) - Safety Standard for Architectural Glazing Materials; current edition.
- D. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice; current edition.
- E. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.

- F. 29 CFR 1910, Subpart D - Walking-Working Surfaces, 1910.21-1910.30; current edition.
- G. 29 CFR 1910.23 - Ladders; current edition.
- H. 29 CFR 1910.28 - Duty to have Fall Protection and Falling Object Protection; Current Edition.
- I. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.
- J. 29 CFR 1910.38 - Emergency action plans; current edition.
- K. 29 CFR 1910.132-138 - Plastic Pipe: Qualifying Persons to Make Joints; current edition.
- L. 29 CFR 1910.134 - Respiratory protection; current edition.
- M. 29 CFR 1926.62 - Lead; current edition.
- N. 29 CFR 1926.1101 - Asbestos; Current Edition.
- O. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- P. 39 CFR 111 - U.S. Postal Service Standard 4C; Current Edition.
- Q. AHRI 340/360 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500 MM (12- to 60-in.) Diameter; 2013.
- R. 40 CFR 60 - Standards of Performance for New Stationary Sources; Current Edition.
- S. 40 CFR 273 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2005.
- T. 40 CFR 280 - Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks; current edition.
- U. 40 CFR 761 - Water Resistance: Hydrostatic Pressure Test; 2014.
- V. 47 CFR 15 - Electrostatic Propensity of Carpets; 2011.
- W. 47 CFR 68 - Connection of Terminal Equipment to the Telephone Network; Current Edition .
- X. 49 CFR 37 - Transportation Services for Individuals with Disabilities (ADA); current edition.
- Y. AAMA 1402 - Test Method for Colorfastness to Light; 2004.
- Z. 49 CFR 192.285 - Plastic Pipe: Qualifying Persons to Make Joints; current edition.

3.02 CPSC -- CONSUMER PRODUCTS SAFETY COMMISSION

- A. CPSC Pub. No. 325 - Public Playground Safety Handbook; 2010.

3.03 EPA -- ENVIRONMENTAL PROTECTION AGENCY

- A. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- B. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; 1990.
- C. EPA 600-4-790-20 - Methods for Chemical Analysis of Water and Wastes; 1983.
- D. EPA 625/1-86/021 - Design Manual: Municipal Wastewater Disinfection; 1986.
- E. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; 1999.

- F. EPA 712-C-02-190 - Health Effects Test Guidelines OPPTS 870.1100 Acute Oral Toxicity; 1996.

3.04 FDA -- FOOD AND DRUG ADMINISTRATION

- A. FDA Food Code - Chapter 6 - Physical Facilities; Current Edition.

3.05 FEMA -- U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY

- A. FEMA (MAPS) - FEMA Map Service Center; Current Edition.
- B. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
- C. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
- D. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.
- E. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.

3.06 FS -- FEDERAL SPECIFICATIONS AND STANDARDS (GENERAL SERVICES ADMINISTRATION)

- A. FED-STD-595C - Colors Used in Government Procurement (Fan Deck); 2008 (Chg Notice 1).
- B. FS L-F-001641 - Floor Covering Translucent or Transparent Vinyl Surface with Backing; 1971, and Amendment 2, 1982.
- C. FS L-S-125 - Screening, Insect, Nonmetallic; 1972b, with Notice (1987).
- D. FS RR-P-1352 - Partitions, Toilet, Complete; Revision C, 1989.
- E. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant; 1994e.
- F. FS RR-W-365 - Wire Fabric (Insect Screening); 1980, Rev. A (Amended 1986).
- G. FS SS-T-312 - Tile, Floor: Asphalt, Rubber, Vinyl, and Vinyl Composition; Revision B, 1974, and Amendment 1, 1979.
- H. FS TT-B-1325 - Beads (Glass Spheres); Retro-Reflective; 2007d (Validated 2017).
- I. FS TT-P-115 - Paint, Traffic (Highway, White and Yellow); Revision F, 1984.
- J. FS TT-P-1952 - Paint, Traffic Black, and Airfield Marking, Waterborne; 2015f.
- K. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).
- L. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2017h.
- M. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); 2017g.
- N. STATE STD 01.01 - Certification Standard Forced Entry and Ballistic Resistance of Structural Systems; Physical Security Division, Office of Physical Security Programs, Bureau of Diplomatic Security, United States Department of State; 1993.
- O. UFC 4-010-01 - DoD Minimum Antiterrorism Standards for Buildings; 2012.
- P. USPS Handbook AS-503 - Standard Design Criteria; United States Postal Service; 2010.

3.07 GSA -- U.S. GENERAL SERVICES ADMINISTRATION

- A. GSA PBS-P100 - Facilities Standards for the Public Buildings Service; General Services Administration; 2017.

3.08 NIJ -- NATIONAL INSTITUTE OF JUSTICE (DEPT. OF JUSTICE)

- A. NIJ 0108.01 - Standard for Ballistic Resistant Protective Materials; 1985.

3.09 PS -- PRODUCT STANDARDS

- A. PS 1 - Structural Plywood; 2009.
- B. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.
- C. PS 20 - American Softwood Lumber Standard; 2015.

3.10 USDA -- UNITED STATES DEPARTMENT OF AGRICULTURE

- A. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2013.

3.11 USGS -- UNITED STATES GEOLOGICAL SURVEY

- A. USGS (FMWQ) - National Field Manual for the Collection of Water-Quality Data; United States Geological Survey; current edition.

END OF SECTION

SECTION 01 45 33
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Division of the State Architect (DSA) Procedures for construction oversight and inspections required during the course of construction.
- B. Code-required special inspections.
 - 1. Division of the State Architect (DSA) approved testing laboratory services and inspections required during the course of construction.
- C. Testing services incidental to special inspections.
- D. Submittals.
- E. Manufacturers' field services.
- F. Fabricators' field services.

1.02 RELATED REQUIREMENTS

- A. Document 00 01 02 – Project Information.
- B. Section 01 33 00 – Submittal Procedures.
- C. Section 01 40 00 - Quality Requirements.
- D. Section 01 42 19 - Reference Standards.
- E. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 DEFINITIONS

- A. Code or Building Code: California Building Code and, more specifically, Chapter 17A - Structural Tests and Special Inspections, of same.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located. AHJ for this Project is Division of the State Architect.
- C. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the CBC that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by District or Contractor for the purposes of quality assurance and contract administration.

1.04 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

1. Use 2014 as indicated in 2016 CBC Referenced Standards
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
 1. Use 2010 with Supplements No. 1 and 2, excluding Chapter 14 and Appendix 11A, as indicated in 2016 CBC Referenced Standards.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
 1. Use 2012 as indicated in 2016 CBC Referenced Standards.
- D. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.
- E. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.
 1. Use 2009b as indicated in 2016 CBC Referenced Standards.
- F. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.
- G. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2018b.
 1. Use 2012 as indicated in 2016 CBC Referenced Standards.
- H. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.
 1. Use 2010 as indicated in 2016 CBC Referenced Standards.
- I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2018.
 1. Use 2010 as indicated in 2016 CBC Referenced Standards.
- J. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- K. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012, with Editorial Revision (2015).
 1. Use 2012 as indicated in 2016 CBC Referenced Standards.
- L. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- M. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2018.
- N. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2015.
- O. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2018.
 1. Use 2010AE1 as indicated in 2016 CBC Referenced Standards.
- P. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a (Reapproved 2015).
- Q. ASTM E2570/E2570M - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage; 2007, with Editorial Revision (2014).
 1. Use 2007 as indicated in 2016 CBC Referenced Standards

- R. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
 - 1. Use 2011 as indicated in 2016 CBC Referenced Standards
- S. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.
- T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

1.05 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ.
- C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Testing and inspections will be performed by an independent testing laboratory selected and employed by the District and approved by the Division of the State Architect (DSA).
 - a. Qualification of a testing agency or laboratory will be under the jurisdiction of the DSA Structural Safety Section (SSS). Procedural and acceptance criteria are set forth in the California Administrative Code (CBC) Chapter 4.
- D. Manufacturer's Qualification Statement: Manufacturer is required to submit documentation of manufacturing capability and quality control procedures. Include documentation of AHJ approval.
- E. Fabricator's Qualification Statement: Fabricator is required to submit documentation of fabrication facilities and methods as well as quality control procedures. Include documentation of AHJ approval.
- F. Distribution List: The Testing Laboratory will make the following distribution of test and inspection reports:

1. District	1
2. Architect	2
3. Structural Engineer	1
4. Contractor	1
5. District's Inspector	1
6. Division of the State Architect	1
7. Construction Manager	1

- G. Each and every test or inspection report shall bear the File Number and Application Number assigned to this project by the DSA.
- H. DSA Form 291 shall be from the engineering manager of the laboratory of record.
- I. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one each to the distribution list.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Compliance with Contract Documents.
 - 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- J. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one each to the distribution list.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of fabricated item and specification section.
 - f. Location in the Project.
 - g. Results of special inspection.
 - h. Verification of fabrication and quality control procedures.
 - i. Compliance with Contract Documents.
 - j. Compliance with referenced standard(s).
- K. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one each to the distribution list.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.

- f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.
 - i. Results of test or inspection.
 - j. Compliance with Contract Documents.
 - k. Test reports shall be signed by a Civil Engineer licensed in the State of California.
2. Test reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory.
 - a. Samples taken but not tested shall also be reported.
 - b. Records of special sampling operations as required shall also be reported.
 - c. Reports shall show that the material or materials were sampled and tested in accordance with the requirements of the CBC, and with the approved specifications.
 - d. They shall also state definitely whether or not the material or materials tested comply with requirements.
 - e. Test reports shall be issued within 14 days of finding being known, to all parties listed above.
 3. At the completion of the project, Testing Laboratory shall certify in writing and on all required DSA forms, that all work specified or required to be tested and inspected conforms to drawings, specifications and applicable building codes.
 4. Verification of Test Reports:
 - a. The Testing Laboratory of record shall submit to the Division of the State Architect (DSA) a verified report covering all tests which are required to be made by that agency during the progress of the project.
 - 1) Such report shall be furnished each time that work on the project is suspended, covering the tests up to that time, and at the completion of the project.
 - b. DSA Form 292 - Special Inspection Verified Report shall be from all special inspectors contracting directly and individually with the school board.
- L. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.
- M. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
1. Submit report in duplicate within 7 days of observation to Architect for information.
 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.
- N. Fabricator's Field Reports: Submit reports to Architect and AHJ.
1. Submit report in duplicate within 30 days of observation to Architect for information.

2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

1.06 SPECIAL INSPECTION AGENCY

- A. District will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with 1 and required by the building code.
- B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
- C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.07 TESTING AND INSPECTION AGENCIES

- A. District is to employ services of an independent inspection and testing agency to perform observation, testing and sampling associated with special inspections including those not required by the building code. CAC
 1. Project Inspector and testing lab are employed by the District and approved by:
 - a. A/E of Record.
 - b. Structural Engineer (when applicable).
 - c. DSA.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.08 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
- B. Testing Agency Qualifications:
 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
- C. Testing and inspection services which are performed shall be in accordance with requirements of the CBC, and as specified herein. Testing and inspection services shall verify that work meets the requirements of the Construction Documents.
- D. In general, tests and inspections for structural materials shall include all items enumerated on the Structural Tests and Inspections list for this project as prepared and distributed by the Architect.
- E. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

1.09 INSPECTION BY THE DISTRICT

- A. The District shall have the right to reject materials and workmanship which are defective, or to require their correction.

1. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the District.
 2. If the Contractor does not correct such rejected work within a reasonable time, the District may correct such rejected work and charge the expense to the Contractor.
- B. Should it be considered necessary or advisable by the District at any time before final acceptance of the entire work to make an examination of work already completed by removing or tearing out the completed work; the Contractor shall on request promptly furnish necessary facilities, labor and materials.
1. If such work is found to be defective in any respect due to fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. .
 2. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

1.10 DISTRICT'S INSPECTOR

- A. An Inspector employed by the District and approved by Architect, Structural Engineer and DSA in accordance with the requirements of the California Building Code will be assigned to the work.
1. IOR duties are specifically defined in CCR Title 24 Part 1, Sec. 4-211(b), 4-214, 4-219, and Group 1 Sec. 4-342.
- B. The District's Inspector shall at all times have access for the purpose of inspection to all parts of the work and to the shops where the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
- C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the District's Inspector.
1. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials.
 2. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.
 3. Inspector of Record is required to work a normal 40 hour week on this project only. Any overtime required will be at the expense of the Contractor and sub-contractor requiring the inspection.

1.11 PAYMENTS

- A. Costs of initial testing and inspection, except as specifically modified herein, or specified otherwise in technical sections, will be paid for by the District, providing such testing and inspection indicates compliance with Contract Documents. Initial tests and inspections are defined as the first tests and inspections as herein specified.
- B. In the event a test or inspection indicates failure of a material or procedure to meet requirements of Contract Documents, costs for retesting and reinspection will be paid by the District and backcharged to the Contractor.

- C. Additional tests and inspections not herein specified but requested by District or Architect, will be paid for by District, unless results of such tests and inspections are found to be not in compliance with Contract Documents, in which case the District will pay all costs for initial testing as well as retesting and reinspection and backcharge the Contractor.
- D. Costs for additional tests or inspections required because of change in materials being provided or change of source or supply will be paid by District and backcharged to the Contractor.
- E. Costs for tests or inspections which are required to correct deficiencies will be paid by the District and backcharged to the Contractor.
- F. Cost of testing which is required solely for the convenience of Contractor in his scheduling and performance of work will be paid by the District and backcharged to the Contractor.
- G. Overtime costs for testing and inspections performed outside the regular work day hours, including weekends and holidays, will be paid for by the District and backcharged to the Contractor. Such costs include overtime costs for the District's Inspector.
- H. Testing Laboratory shall separate and identify on the invoices, the costs covering all testing and inspections which are to be backcharged to the Contractor as specified above.
- I. Testing Laboratory shall furnish to District a cost estimate breakdown covering initial tests and inspections required by Contract Documents. Estimate shall include number of tests, man-hours required for tests, field and plant inspections, travel time, and costs.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- B. Tests and inspections for the following will be required in accordance with DSA IR 17-6 and the current CBC, unless otherwise specified.

3.02 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION (CHAPTER 17A AND 19A)

- A. Inspection:
 - 1. Job Site Inspection: CBC 1705A.3, 1705A.3.5 (Conc. Preplacement), 1705A.3.6 (Placing Record), and 1910A.
 - 2. Batch Plant or Weighmaster Inspection: CBC 1705A.3.3.
 - a. Waiver of Batch Plant Inspection:

- 1) Batch plant inspection may be waived if the concrete plant complies fully with the requirements of CBC 1705A.3.3 subject to approval of DSA complying with either of these conditions:
 - (a) The plant must comply fully with the requirements of ASTM C94/C94M, Sections 8 and 9, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to the enforcement agency. The certification shall indicate that the plant has automatic batching and recording capabilities.
 - b. Prior to waiving of batch plant inspection, the testing lab must certify and submit evidence of compliance to the Architect and DSA and obtain agency approval prior to mixing concrete.
 - 1) Qualified technician of the testing laboratory shall check the first batching at the start of the day.
 - 2) Licensed weigh-master to positively identify materials as to quantity and certify to each load by a batch ticket.
 - 3) Batch tickets, including material quantities and weights shall accompany the load, shall be transmitted to the Inspector of Record by a truck driver with load identified thereon. The load shall not be placed without a batch ticket identifying the mix. The inspector will keep a daily record of placements, identifying each truck, its load and time of receipt, and approximate location of deposit in the structure and will transmit a copy of the the daily record to the enforcement agency.
- B. Reinforcing Steel, Including: Verify compliance with approved contract documents and ACI 318, Sections 20.2, 25.2 through 256.6, and 26.6.
1. Reinforcing Bars: CBC 1901A.6; 1910A.
 2. Tests:
 - a. Tests shall be performed before the delivery of steel to Project site. Steel not meeting specifications shall not be shipped to the Project.
 - b. Testing procedure shall conform to ASTM A615/A615M or ASTM A706/A706M.
 - c. Sample at the place of distribution, before shipment:
 - 1) Make one tensile test and one bending test from samples out of 10 tons, or fraction thereof, of each size and kind of reinforcing steel, where taken from bundles as delivered from the mill and properly identified as to heat number.
 - 2) Mill analysis shall accompany report.
 - 3) Where identification number cannot be ascertained, or where random samples are taken, make one series of tests from each 2-1/2 tons, or fraction thereof, of each size and kind of reinforcing steel.
 - 4) Tests on unidentified reinforcing steel will be paid by the District and backcharged to the Contractor.
 - 5) Samples shall include not fewer than 2 pieces, each 18 inches long, of each size and kind of reinforcing steel.
 - d. District's Inspector will inspect all reinforcement for concrete work for size, dimensions, locations and proper placement.
- C. Reinforcing Bar Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, 26.6.4; continuous.

1. Verify weldability of reinforcing bars other than those complying with ASTM A706/A706M; periodic.
 2. Inspect single-pass fillet welds, maximum 5/16 inch; periodic.
 3. Inspect all other welds; continuous.
 4. Reinforcing Bar Welding Inspection: CBC 1705A.3.1; Table 1705A.3, Item 2; 1903A.8.
- D. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI 318 approved report prior to and during placement of concrete; continuous.
1. Comply with CBC Section 1910A.5; Table 1705A.3, items 4a & 4b, ASCE 7, Section 13.4, and DSA Bulletin 14-02, 2/20/14.
- E. Anchors Installed in Hardened Concrete: Verify compliance with ACI 318; periodic.
- F. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 19A, 26.4.3, 26.4.4; periodic.
1. Portland Cement Tests: CBC 1705A.3.2, 1910A.
 2. Concrete Aggregates: CBC 1705A.3.2, 1903A.5.
 3. Batch Plant Inspection: CBC 1705A.3.2.
 4. Waiver of Batch Plant Inspection and Tests: CBC 1705A.3.3.
 5. Admixtures: CBC 1910A.1.
- G. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Chapter 26.5, 26.12, and record the following, continuous:
1. Slump.
 2. Air content.
 3. Temperature of concrete.
 4. Strength Tests of Concrete: CBC 1905A.1.16; Table 1705A.3 Item 6; ACI 318-14 Sec. 26.13..
- H. Concrete and Shotcrete Placement: Verify application techniques comply with approved Contract Documents and ACI 318, Chapter 26.5; continuous.
- I. Specified Curing Temperature and Techniques: Verify compliance with 1, Chapter 26.5.3-26.5.5; continuous.
- J. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, Sections 5.11 through 5.13; continuous.
- K. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents, CBC Table 1705A.3, and modified ACI 318, Chapter 26.12.2,1(a).
- L. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents, CBC Table 1705A.3 and ACI 318, Section 6.2, for the following.
- M. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Chapter 26.11.1.2(b); periodic.
- N. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials conform to the quality standards of ACI 318, the AHJ will require that the

Special Inspector verify compliance with the appropriate standards and criteria in ACI 318, Chapter 3. CBC 1705A3.

- O. District Inspector (IOR) will do the following:
1. Inspect placing of reinforcing steel and concrete at Project.
 2. Obtain weighmaster's certificate and identify mix before accepting each load.
 3. Keep daily record of concrete placement, identifying each truck load, time of receipt, and location of concrete in structure.
 4. Keep record until completion of Project and make available for inspection by DSA Field Engineer or representative.
 5. See also subparagraph on Waiver of Batch Plant Inspection above.
 6. During progress of work, take an additional number of test cylinders as directed by Architect. Conform to CBC 1905A.1.16 (modified ACI 318). Test cylinders need not be made for concrete used in exterior flatwork.
 - a. ACI 318 Section 26.12.2.1 shall be replaced and the Contractor shall comply with the following:
 - 1) Samples for strength test of each class of concrete placed each day shall not be taken less than once for each 50 cubic yards (38.3m³) of concrete, or not less than once for each 2,000 square feet (186 m²) of surface area of for slabs or walls.
 - 2) Additional samples for seven day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.
 7. One set of cylinders shall consist of 4 samples all taken from same batch, one to be tested at age of 7 days and two at 28 days.
 8. Make and store cylinders according to ASTM C31/C31M.
 9. Deliver cylinders to laboratory or store cylinders in a suitable protected environment for pick up by laboratory personnel.
 10. Make slump test of wet concrete according to test for slump of portland cement concrete, ASTM C143/C143M, at least at the same frequency that the cylinders are taken.

3.03 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
1. Design bearing capacity of material below shallow foundations; periodic.
 2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
 4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.
- B. Testing: Classify and test excavated material; periodic.
- C. Excavations, Foundations and Retaining Walls (Chapters 17A, 18A, and 33):

1. Earth Compaction: CBC 1705A.6; Table 1705A.6, continuous; 1804A.6.
 2. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of compacted fill: CBC 1705A.6.1; Table 1705A.6, periodic; 1804A.6.
- D. The Geotechnical Engineer of record or a Geotechnical Engineer selected by the District will provide continuous inspection of fill and will field test fill and earth backfill as placed and compacted, and inspect excavations and subgrade before concrete is placed and provide periodic inspection of open excavations, embankments, and other cuts or vertical surfaces of earth.
1. The Geotechnical Engineer will submit a Verified Report indicating observations, tested fills, and opinion the fills were placed in accordance with the project specifications.
- E. Contractor shall remove unsatisfactory material, re-roll, adjust moisture, place new material, or in the case of excavations, provide proper protective measures, perform other operations necessary, as directed by the Geotechnical Engineer whose decisions and directions will be considered final.
- F. Soils Test and Inspection Procedure:
1. Allow sufficient time for testing, and evaluation of results before material is needed. The Geotechnical Engineer shall be sole and final judge of suitability of all materials.
 2. Laboratory compaction tests to be used will be in accordance with ASTM D1557.
 3. Field density tests will be made in accordance with ASTM D1556/D1556M.
 4. Number of tests will be determined by Geotechnical Engineer. Materials in question may not be used pending test results.
 5. Excavation and embankment inspection procedure. Geotechnical Engineer will visually or otherwise examine such areas for bearing values, cleanliness and suitability.
 6. Earthwork Test Reports: In order to avoid misinterpretations by the reviewing agencies, all retest results shall be reported on the same sheet, immediately following the previous failure test to which it is related. Retests shall be clearly noted as such.

3.04 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS

- A. Verify penetration firestops in accordance with ASTM E2174.
- B. Verify fire resistant joints in accordance with ASTM E2393.
- C. Inspection: Comply with CBC 1705A.17.

3.05 SPECIAL INSPECTIONS FOR FIRE DOOR ASSEMBLIES

- A. Per NFPA 80 5.2.1:
 1. Provide a third party inspector not associated with the construction, supply or installation of this project to develop a field survey of the doors and hardware.
 2. Survey is to be done by a member certified as a FDAI (Fire Door Assembly Inspector), Certified AHC (Architectural Hardware Consultant) or a certified testing laboratory: UL or Intertek.
 3. Certified Inspectors may be found at DHI.org, Intertek, or CAFDI.org.

3.06 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

- A. Architectural Components: Erection and fastening of components below; periodic.
 - 1. Exterior cladding; per ICC ESR Report when applicable.
 - 2. Interior and exterior veneer.
 - 3. Interior and exterior non-loadbearing walls and partitions.
 - 4. Suspended ceiling systems and their anchorage, per ICC ESR Report. CBC Section 1705A.12.5 and 1705A.13.2.
- B. Mechanical and Electrical Components:
 - 1. Anchorage of electric equipment required for emergency or standby power systems; periodic.
 - 2. Installation and anchorage of other electrical equipment; periodic.
 - 3. Vibration isolation systems where the approved Contract Documents require a nominal clearance of 1/4 inch or less between support frame and seismic restraint; periodic.
- C. Structural Observations for Seismic Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

3.07 SPECIAL INSPECTIONS FOR WIND RESISTANCE

- A. Structural Wood:
 - 1. Nailing, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic.
- B. Wind Resisting Components:
 - 1. Roof covering, roof deck, and floor framing connections; periodic.
 - 2. Exterior wall covering and wall connections to roof and floor diaphragms and framing; periodic.

3.08 SPECIAL ARCHITECTURAL INSPECTIONS

- A. Signs and/or identification devices:
 - 1. Prior to issuance of a final Certificate of Occupancy, Enforcing Agency shall verify installation of signs for information content, appearance, location and Braille per CBC 11B-703.1.1.2.
 - a. Inspection shall include, but not limited to:
 - 1) Braille dots and cells are properly spaced and the size proportion and type raised characters are in compliance with these regulations.
 - 2) Tactile exit signage per CBC 1013.4 and 11B-216.4.1 Exit doors.
 - 3) Sanitary facilities signage per CBC 11B-216.8 Toilet rooms and bathing rooms; and 11B-703.7.2.6 Toilet and bathing facilities geometric symbols.
- B. Water-resistive barrier coating:
 - 1. Installation over sheathing substrate per ASTM E2570/E2570M.
- C. Glass and glazing identification:
 - 1. Verify installation of manufacturer's material mark inspection per CBC 2403.1.
 - a. Safety glazing shall be labeled per CBC 2406.3.

3.09 OTHER SPECIAL INSPECTIONS

- A. Provide for special inspection of work that, in the opinion of the AHJ, is unusual in nature.
- B. For the purposes of this section, work unusual in nature includes, but is not limited to:
 - 1. Construction materials and systems that are alternatives to materials and systems prescribed by the building code.
 - 2. Materials and systems required to be installed in accordance with the manufacturer's instructions when said instructions prescribe requirements not included in the building code or in standards referenced by the building code.
- C. Alternative Test Procedures: Where approved rules and standards do not exist, test materials and assemblies as required by AHJ or provide AHJ with documentation of quality and manner in which those materials and assemblies are used.

3.10 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 4. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 5. Promptly notify Architect, SEOR, IOR, DSA, District and Contractor of observed irregularities or non-conformance of work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Submit reports of all tests or inspections specified.
- B. Limits on Special Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
- C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.11 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
 - 1. Test samples submitted by Contractor.

2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 3. Perform specified sampling and testing of products in accordance with specified standards.
 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by Architect.
 7. Attend preconstruction meetings and progress meetings.
 8. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the work.
 3. Agency may not assume any duties of Contractor.
 4. Agency has no authority to stop the work.
- C. Immediately upon determination of a test failure, the Laboratory shall telephone the results to the Architect. On the same day, Laboratory shall send test results by email to the Architect and to all relevant responsible parties of the project team, and District's Inspector
- D. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- E. Contractor will pay for re-testing required because of non-compliance with specified requirements.
- F. At the completion of the project, Testing Laboratory shall certify in writing and on all required DSA forms, that all work specified or required to be tested and inspected conforms to drawings, specifications and applicable building codes.
1. See DSA Procedure PR 13-01.
- G. Duties of the Laboratory of Record related to the use of form DSA 152 are as follows:
1. Meet with the Project Inspector, design professionals, and contractor as needed to mutually communicate and understand the testing and inspection program and the methods of communication appropriate for the project.
 2. Obtain a copy of the DSA approved construction documents from the design professional in general responsible charge prior to the commencement of construction
 3. Obtain a copy of the DSA approved Statement of Structural Tests and Special Inspections (form DSA 103) from the design professional in general responsible charge prior to the commencement of construction.
 4. Report all project related activities to the Project Inspector. The Project Inspector is responsible for monitoring the work of the Laboratory of Record and Special Inspectors to ensure the testing and special inspection program is satisfactorily completed
 5. Provide material testing as identified in the DSA approved construction documents.

6. Submit test reports to the Project Inspector on the day the tests were performed for any tests performed on-site
 7. Submit material test reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the material tests were performed. Test reports are to be submitted to DSA, the Architect, structural engineer, Project Inspector and school district.
 - a. As a convenience, and if agreed upon by involved parties, the test reports may be submitted electronically as identified in Section 4 of this procedure.
 8. Immediately submit reports of material tests not conforming to the requirements of the DSA approved construction documents. These reports shall be submitted to the DSA, Architect, structural engineer, Project Inspector and school district.
 9. The Engineering Manager shall submit an interim Laboratory of Record Verified Report (form DSA 291) and the Geotechnical Engineer shall submit an interim Geotechnical Verified Report (form DSA 293) to DSA, the project inspector, school district and the Design Professional in General Responsible Charge.
 - a. The reports are required to be submitted upon any of the following events occurring:
 - 1) Within 14 days of the completion of the material testing/special inspection program.
 - 2) Work on the project is suspended for a period of more than one month.
 - 3) The services of the laboratory of record are terminated for any reason prior to completion of the project.
 - 4) The DSA requests a Verified Report. (See interim verified reports below. This is a "DSA request.")
 10. The Engineering Manager shall submit an interim verified report (form DSA 291) and the Geotechnical Engineer shall submit form DSA 293 to DSA and a copy to the project inspector for each of the applicable sections of the form DSA 152, prior to the project inspector signing off that section of the project inspection card, if that section required material testing. The sections are:
 - a. Initial Site Work
 - b. Foundation Prep
 - c. Vertical Framing
 - d. Horizontal Framing
 - e. Appurtenances
 - f. Finish Site Work
 - g. Other Work
 - h. Final
- H. Duties of Special Inspectors, employed by the Laboratory of Record, related to the use of form DSA 152 are as follows:
1. Meet with the Project Inspector, design professionals, and contractor as needed to mutually communicate and understand the testing and inspection program and the methods of communication appropriate for the project.

2. Report all project related activities to the Project Inspector. The Project Inspector is responsible for monitoring the work of the Laboratory of Record and Special Inspectors to ensure the testing and special inspection program is satisfactorily completed.
3. Perform work under the supervision of the Engineering Manager for the Laboratory of Record
4. Perform inspections in conformance with the DSA approved construction documents, applicable codes and code reference standards
5. Prepare detailed daily inspection reports outlining the work inspected and provide the Project Inspector a copy of the reports on the same day the inspections were performed.
6. Prepare detailed daily inspection reports outlining the work inspected and provide the Project Inspector a copy of the reports on the same day the inspections were performed.
7. Immediately submit reports of materials or work not conforming to the requirements of the DSA approved construction documents. These reports shall be submitted to the DSA, Architect, structural engineer, Project Inspector and school district.
8. Submit daily special inspection reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the special inspections were performed. The reports are to be submitted to the Architect, structural engineer, Project Inspector and school district.
9. Submit Verified Report forms DSA 292 to the DSA, Project Inspector, district and design professional in responsible charge.
10. The reports are required to be submitted upon any of the following events occurring:
 11. Within 14 days of the completion of the special inspection work.
 12. Work on the project is suspended for a period of more than one month.
 13. The services of the special inspector are terminated for any reason prior to completion of the project.
 14. The DSA requests a Verified Report. (See interim verified reports below. This is a "DSA request")
 15. Submit an interim Verified Report (form DSA 292) to the DSA and a copy to the Project Inspector for each of the applicable sections of the form DSA 152, prior to the Project Inspector signing off that section of the project inspection card, if that section required special inspections. The sections are:
 - a. Initial Site Work
 - b. Foundation
 - c. Vertical Framing
 - d. Horizontal Framing
 - e. Appurtenances
 - f. Non-Building Site Structures
 - g. Finish Site Work
 - h. Other Work
 - i. Final
16. The Verified Reports shall be sent electronically to the DSA.

- I. Duties of Special Inspectors, not employed by the Laboratory of Record, related to the use of form DSA 152 are as follows:
 1. Meet with the project inspector, Laboratory of Record, the design professionals, and the contractors as needed to mutually communicate and understand the testing and inspection program, and the methods of communication appropriate for the project.
 2. Report all project related activities to the project inspector. The project inspector is responsible for monitoring the work of the Laboratory of Record and special inspectors to ensure the testing and special inspection program is satisfactorily completed.
 3. Perform work under the direction of the design professional in general responsible charge, as defined in Section 4-335(f)1B of the California Administrative Code (Title 24, Part 1).
 4. Perform inspections in conformance with the DSA approved construction documents, applicable codes and code reference standards.
 5. Prepare detailed daily inspection reports outlining the work inspected and provide the project inspector a copy of the reports on the same day the inspections were performed.
 6. Immediately submit reports of materials or work not conforming to the requirements of the DSA approved construction documents. These reports shall be submitted to DSA, the Architect, structural engineer, project inspector and the school district.
 7. Submit daily special inspection reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the special inspections were performed. The reports are to be submitted to DSA, the Architect, structural engineer, project inspector and the school district.
 8. Submit Special Inspection Verified Report forms DSA 292 to DSA, the project inspector, the school district and the Design Professional in General Responsible Charge.
 - a. The reports are required to be submitted upon any of the following events occurring:
 - 1) Within 14 days of the completion of the special inspection work.
 - 2) Work on the project is suspended for a period of more than one month.
 - 3) The services of the special inspector are terminated for any reason prior to completion of the project.
 - 4) DSA requests a verified report. (See interim verified reports below. This is a "DSA request.")
 9. Submit an interim Special Inspection Verified Report (form DSA 292) to DSA and a copy to the project inspector for each of the applicable sections of the form DSA 152, prior to the project inspector signing off that section of the project inspection card, if that section required special inspections.
 - a. The sections are:
 - 1) Initial Site Work
 - 2) Foundation Prep
 - 3) Vertical Framing
 - 4) Horizontal Framing
 - 5) Appurtenances
 - 6) Finish Site Work
 - 7) Other Work

3.12 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. DSA Requirements:

1. Each Multi-Prime Contractor or Subcontractor shall comply with DSA Construction Oversight Procedure PR 13-01. California Code of Regulations (CCR), Title 24, Part 1, CCR, Chapter 4, Article 1 (Sections 4-211 through 4-220) and Group 1, Articles 5 and 6 (Sections 4-331 through 4-344) which provide regulations governing the construction process for projects under the jurisdiction of the Division of the State Architect (DSA).
 - a. Assist the Project Inspector (IOR) and complete and fill out the following forms during the course of construction.
 - 1) Form-102-IC: Construction Start Notice/ Inspection Card Request: Verify Project Inspector has an active form issued by DSA.
 - 2) Form-151: Project Inspector Notifications: Contractor to notify IOR and assist.
 - 3) Form-152: Project Inspection Card: See below.
 - 4) Form-154: Notice of Deviations/ Resolution of Deviations: Contractor to verify all deviations are reviewed, corrected, and accepted by the design professional, and filed with DSA through the Project Inspector (IOR).
 - (a) When the Project Inspector identifies deviations from the DSA approved construction documents the inspector must verbally notify the contractor. If the deviations are not corrected within a reasonable time frame, the inspector is required to promptly issue a written notice of deviation to the contractor, with a copy sent to the design professional in general responsible charge and the DSA.
 - (b) When the noticed deviations are corrected, the inspector is required to promptly issue a written notice of resolution to the contractor, with a copy sent to the design professional in general responsible charge and the DSA.
 - (c) Deviations include both construction deviations and material deficiencies.
 - (d) The written notice of deviations shall be made using form DSA 154.
 - (e) The notice of resolution of deviations shall be made using the original form DSA 154 that reported the deviations.
 - 5) Form-156: Commencement/Completion of Work Notification
 - 6) Form-6.C: Verified Report – Contractor: From each contractor having a contract with the school board.
2. Duties of Contractor related to the use of form DSA 152 are as follows:
 - a. The Contractor shall carefully study the DSA approved documents and shall plan a schedule of operations well ahead of time.
 - b. If at any time it is discovered that work is being done which is not in accordance with the DSA approved construction documents, the Contractor shall correct the work immediately.
 - c. Verify that forms DSA 152 are issued for the project prior to the commencement of construction.
 - d. Meet with the design team, the Laboratory of Record and the Project Inspector to mutually communicate and understand the testing and inspection program and the methods of communication appropriate for the project.

- e. Notify the Project Inspector, in writing, of the commencement of construction of each and every aspect of the work at least 48 hours in advance by submitting form DSA 156 (or other agreed upon written documents) to the Project Inspector.
- f. Notify the Project Inspector of the completion of construction of each and every aspect of the work by submitting form DSA 156 (or other agreed upon written documents) to the Project Inspector.
- g. Consider the relationship of the signed off blocks and sections of the form DSA 152 and the commencement of subsequent work. Until the Project Inspector has signed off applicable blocks and sections of the form DSA 152, the Contractor may be prohibited from proceeding with subsequent construction activities that cover up the unapproved work. Any subsequent construction activities, that cover up the unapproved work, will be subject to a "Stop Work Order" from the DSA or the district and are subject to removal and remediation if found to be in non-compliance with the DSA approved construction documents.
- h. Submit the final verified report. All prime contractors are required to submit final Contractor Verified Reports (form DSA 6-C) to DSA and the project inspector.
 - 1) The reports are required to be submitted upon any of the following events occurring:
 - (a) The project is substantially complete. DSA considers the project to be complete when the construction is sufficiently complete in accordance with the DSA approved construction documents so that the owner can occupy or utilize the project.
 - (b) Work on the project is suspended for a period of more than one month.
 - (c) The services of the contractor are terminated for any reason prior to the completion of the project.
 - (d) DSA requests a verified report.

B. Contractor Responsibilities, General:

- 1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
- 2. Availability of Samples
 - a. Contractor shall make materials required for testing available to Laboratory and assist in acquiring these materials as directed by the District's Inspector. The samples shall be taken under the immediate direction and supervision of the Testing Laboratory or District's Inspector.
 - b. If work which is required to be tested or inspected is covered up without prior notice or approval, such work may be uncovered at the discretion of Architect at no additional cost to the District. Refer to paragraph "Payments" herein.
 - c. Unless otherwise specified, Contractor shall notify Testing Laboratory a minimum of 10 working days in advance of all required tests, and a minimum of 2 working days in advance of all required inspections. All extra expenses resulting from a failure to notify the Laboratory will be paid by the District and backcharged to the Contractor.
 - d. Contractor shall give sufficient advance notice to Testing Laboratory in the event of cancellation or time extension of a scheduled test or inspection. Charges due to insufficient advance, notice of cancellations, or time extension will be paid for by the District and backcharged to the Contractor.

3. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
 4. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 5. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 6. Arrange with District's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 7. The Contractor shall notify the District's Inspector a minimum of 5 working days in advance of the manufacture of material to be supplied by him under the Contract Documents, which must be by terms of the Contract be tested, in order that the District may arrange for the testing of such material at the source of supply.
 8. Material shipped by the Contractor from the source of supply before having satisfactorily passed such testing and inspection or before the receipt of notice from said Inspector that such testing and inspection will not be required, shall not be incorporated in the Project.
 9. The District will select and pay testing laboratory costs for all tests and inspections, but may be reimbursed by the Contractor for such costs under the Contract conditions. Any direct payments by the Contractor to the testing laboratory on this project is prohibited.
- C. Contractor shall submit a written statement of responsibility to comply with CBC section 1704A.4.
1. Each contractor responsible for the construction of a main wind- or seismic-force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain the following:
 - a. Acknowledgment of awareness of the special requirements contained in the statement of special inspections;
 - b. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official;
 - c. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports; and
 - d. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.
- D. Contractor Responsibilities, Seismic Force-Resisting System, Designated Seismic System, and Seismic Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and District prior to starting work.

Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

- E. Contractor Responsibilities, Wind Force-Resisting System and Wind Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and District prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
- F. Unless otherwise directed, materials not conforming to the requirements of Contract Documents shall be promptly removed from the Project site.

3.13 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

- A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
 - 1. Observer subject to approval of Architect.
 - 2. Observer subject to approval of District.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary telecommunications services.
- B. Temporary sanitary facilities.
- C. Temporary Controls: Barriers, enclosures, and fencing.
- D. Security requirements.
- E. Waste removal facilities and services.
- F. Project identification sign.

1.02 RELATED REQUIREMENTS

- A. Section 01 35 53 - Security Procedures
- B. Section 01 51 00 - Temporary Utilities.
- C. Section 01 57 19 - Temporary Environmental Controls: Filtration requirements during construction and final cleaning.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
 - 1. Use 2013a as indicated in 2016 CBC Referenced Standards.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.04 TEMPORARY UTILITIES - SEE SECTION 01 51 00

- A. District will provide the following:
 - 1. Electrical power and metering, consisting of connection to existing facilities.
 - 2. Water supply, consisting of connection to existing facilities.
- B. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.05 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:

1.06 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
 - 1. Provide temporary toilet facilities if maximum number of personnel on project is greater than 10.
 - 2. Submit proposed location of temporary toilet(s) to Construction Manager for approval.
 - a. Place on-site portable toilets away from building air intakes and entryway.
- B. Maintain daily in clean and sanitary condition.

1.07 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 FENCING

- A. Construction: Contractor's option.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.09 EXTERIOR ENCLOSURES

- A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from District-occupied areas, to prevent penetration of dust and moisture into District-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
 - 1. STC rating of 35 in accordance with ASTM E90.
 - 2. Maximum flame spread rating of 75 in accordance with ASTM E84.
- C. Paint surfaces exposed to view from District-occupied areas.

1.11 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and District's operations from unauthorized entry, vandalism, or theft.

- B. Coordinate with District's security program.
 - 1. Include construction surveillance camera system per the District.

1.12 CAFETERIA AND FOOD

- A. Construction personnel shall police their own areas. All cups, cans, paper, wrappers, and discarded food must be placed in trash receptacles at end of each break.
- B. Contractor(s) shall submit to Construction Manager proposed location of any break areas and eating areas for approval.

1.13 SMOKING AND TOBACCO

- A. Smoking and vaping is not permitted on school property.
- B. No chewing tobacco or spitting of tobacco is permitted.

1.14 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and District.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.15 WASTE REMOVAL

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.16 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs are allowed without District permission except those required by law.

1.17 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Provide separate private office similarly equipped and furnished, for use of District.
- D. Provide separate private office similarly equipped and furnished, for use of Architect and District.
- E. Locate offices a minimum distance of 30 feet from existing and new structures.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

- A. Section 01 50 00 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.

1.03 REFERENCE STANDARDS

- A. AHRI 560 - Voluntary Specification for Rotary Operators in Window Applications; 2010.

1.04 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Provide power service required from utility source.
- C. Power Service Characteristics: 480 volt, 200 ampere, three phase, four wire.
- D. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.
- E. Provide main service disconnect and over-current protection at convenient location and meter.
- F. Permanent convenience receptacles may be utilized during construction.
- G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of AHRI 560 and authorities having jurisdiction.
- B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.
- C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- D. Maintain lighting and provide routine repairs.
- E. Permanent building lighting may be utilized during construction.

1.06 TEMPORARY HEATING

- A. Cost of Energy: By Contractor.

- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Existing facilities shall not be used.
- E. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.07 TEMPORARY COOLING

- A. Cost of Energy: By Contractor.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Existing facilities shall not be used.

1.08 TEMPORARY VENTILATION

- A. Existing ventilation equipment may not be used.

1.09 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Contractor.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.
- C. Connect to existing water source.
 - 1. Exercise measures to conserve water.
- D. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 52 13
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary field offices for use of Architect.
- B. Temporary field offices for use of Construction Manager.
- C. Temporary field offices for use of Project Inspector.
- D. Temporary field offices for use of Contractor.
- E. Maintenance and removal.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: use of premises and responsibility for providing field offices.
- B. Section 01 50 00 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.
- C. Section 01 55 00: Parking and access to field offices.

1.03 USE OF EXISTING FACILITIES

- A. Existing facilities shall not be used for field offices.

1.04 USE OF PERMANENT FACILITIES

- A. Permanent facilities shall not be used for field offices.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

- A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

- A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
- B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.
- C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy requirements.
- D. Exterior Materials: Weather resistant, finished in one color.
- E. Interior Materials in Offices: Sheet type materials for walls and ceilings, prefinished or painted; resilient floors and bases.
- F. Lighting for Offices: 50 fc at desk top height, exterior lighting at entrance doors.

- G. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

- A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.04 CONTRACTOR OFFICE AND FACILITIES

- A. Size: For Contractor's needs and to provide space for project meetings.
- B. Telephone: As specified in Section 01 50 00.
- C. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.
- D. Other Furnishings: Contractor's option.
- E. Equipment: Six adjustable band protective helmets for visitors, one 10 inch outdoor weather thermometer .

2.05 CONSTRUCTION MANAGER, DISTRICT, OWNER, PROJECT INSPECTOR, ARCHITECT, AND ENGINEER OFFICE

- A. Separate space for sole use of District and Architect, with separate entrance door with new lock and two keys.
- B. Windows: At least three, with minimum total area equivalent to 10 percent of floor area, with an operable sash and insect screen. Locate to provide views of construction area.
- C. Electrical Distribution Panel: Four circuits minimum, 110 volt, 60 hz service.
- D. Minimum for each 10 foot length, provide 110 volt duplex convenience outlets, on each wall of the office open space.
- E. Provide four 110 volt duplex convenience outlets in each office.
- F. Telephone: As specified in Section 01 50 00.
- G. Sanitary Facilities: As specified in Section 01 50 00.
- H. Drinking Fountain: Convenient access by workers.

PART 3 EXECUTION

3.01 PREPARATION

- A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

- A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.
- B. Parking: Two hard surfaced parking spaces for use by District and Architect, connected to office by hard surfaced walk.

3.03 MAINTENANCE AND CLEANING

- A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.
- B. Maintain approach walks free of mud, water, and snow.

3.04 REMOVAL

- A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

SECTION 01 55 00
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Existing pavements and parking areas.
- D. Permanent pavements and parking facilities.
- E. Construction parking controls.
- F. Flag persons.
- G. Flares and lights.
- H. Haul routes.
- I. Traffic signs and signals.
- J. Maintenance.
- K. Removal, repair.
- L. Mud from site vehicles.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: For access to site, work sequence, and occupancy.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Temporary Construction: Contractor's option.
- B. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base, and topping.

2.02 SIGNS, SIGNALS, AND DEVICES

- A. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
- B. Flag Person Equipment: As required by local jurisdictions.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

- B. Limit the number of haul trucks on site and establish a haul route. Install a gravel or base road on site for loading trucks. Haul route shall be reviewed and approved by Construction Manager.
- C. Provide a boundary/zone where equipment shall not enter because of proximity to active adjacent operation, and if necessary, equipment shall operate on alternative fuel to reduce diesel particulate matter.
- D. Establish construction site and access road speed limits and enforce them during the construction period.
- E. Restrict the hours of material transport to the periods and days permitted by both this contract and local noise or other applicable ordinance.
- F. Schedule haul trucks and material delivery trucks to prevent traffic congestion and impede the normal operation of the Facility. Set up truck queuing area away from public entrances.

3.02 ACCESS ROADS

- A. Use of existing on-site streets and driveways for construction traffic is permitted.
- B. Tracked vehicles not allowed on paved areas.
- C. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.
- D. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.
- E. Provide and maintain access to fire hydrants free of obstructions.

3.03 PARKING

- A. Use of designated areas of existing parking facilities by construction personnel is permitted.
 - 1. Construction Manager will meet with Contractor(s) to determine parking requirements.
- B. Construction Manager will notify security of parking area to be used by construction personnel if at variance with this procedure.
- C. Use of designated areas of new parking facilities by construction personnel is permitted.
- D. Contractor(s) and related personnel shall park in authorized areas only.
- E. Do not allow heavy vehicles or construction equipment in parking areas.
- F. Arrange for temporary parking areas to accommodate use of construction personnel.
- G. When site space is not adequate, provide additional off-site parking.

3.04 PERMANENT PAVEMENTS AND PARKING FACILITIES

- A. Prior to Substantial Completion the base for permanent roads and parking areas may be used for construction traffic.
- B. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.05 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and District's operations.

- B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.06 FLAG PERSONS

- A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.07 FLARES AND LIGHTS

- A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.08 HAUL ROUTES

- A. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.09 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Relocate as work progresses, to maintain effective traffic control.

3.10 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.11 REMOVAL, REPAIR

- A. Remove underground work and compacted materials to a depth of 2 feet; fill and grade site as specified.
- B. Repair existing facilities damaged by use, to original condition.
- C. Remove equipment and devices when no longer required.
- D. Repair damage caused by installation.
- E. Remove post settings to a depth of 2 feet.

3.12 MUD FROM SITE VEHICLES

- A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Compensation of District for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 SUMMARY

- A. The District will be filing with the State of California, State Water Resources Control Board a Notice of Intent (N.O.I.) to comply with the terms of the General Permit to Discharge Storm Water Associated with Construction Activity, prior to the beginning of construction on this site.
- B. A copy of the SWPPP will be on file at the Architect's office for review by the Contractors during the bidding period. The Contractor will need to implement and monitor the storm water pollution prevention plan prepared for this site. The Contractor will be required to review the storm water pollution prevention plan and to identify possible pollution sources and mitigation measures with all subcontractors at their starting of work on site.
- C. The Contractor will be obligated to comply with the requirements of the State's General Permit. Any fines or penalties due to failure to comply with the general permit shall be borne by the Contractor.
- D. Prior to construction and after commencement of construction activities, revisions to the SWPPP shall be submitted, by the Contractor, to the Architect for amendment to the general permit by the Civil Engineer.
- E. Storm water pollution prevention plan testing and reporting will be performed by the Contractor until such responsibility is reassigned by the District.

1.03 REFERENCE STANDARDS

- A. California Codes and Regulations; Title 24, California Building Code, Parts 1 & 2.
- B. State of California State Water Resources Control Board Regulations.

1.04 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Comply with pertinent provisions of the general permit.
- C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

- D. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 NOT USED - REFER TO SWPP FOR MATERIALS.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.
- B. Correct conditions detrimental to timely and proper completion of the work.
- C. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 INSTALLATION

- A. Installation of the work shall be as indicated on the Drawings as specified herein and regulatory requirements.
- B. Maintain the protection up to the project completion.

3.04 MAINTENANCE

- A. During and upon completion of the work comply with the general provisions of the general permit.
- B. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- C. Repair deficiencies immediately.
- D. Silt Fences:
 - 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 - 2. Remove silt deposits that exceed one-third of the height of the fence.
 - 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Straw Bale Rows:
 - 1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 - 2. Remove silt deposits that exceed one-half of the height of the bales.
 - 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.05 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction procedures to promote adequate indoor air quality after construction.
- B. Building flush-out after construction and before occupancy.
- C. Testing indoor air quality before commencement of construction; existing building areas only.
- D. Testing indoor air quality after completion of construction.
- E. Testing air change effectiveness after completion of construction.

1.02 PROJECT GOALS

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
 - 1. Cover duct openings and protect mechanical equipment during construction. Provide tape, plastic, sheet metal or other methods acceptable to DSA.
 - a. Comply with California Green Code Section 5.504.3.
 - 2. Cleaning of ductwork is not contemplated under this Contract.
 - 3. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
 - 4. Establish condition of existing ducts and equipment prior to start of alterations.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
 - 1. Furnish products meeting the specifications.
 - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Section 01 50 00 - Temporary Construction Facilities and Controls: Temporary construction requirements.
- C. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- D. Section 01 91 13 - General Commissioning Requirements: Verification of installed Work and it's performance.
- E. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): HVAC filters.
- F. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Testing HVAC systems for proper air flow rates, adjustment of dampers and registers, and settings for equipment.
- G. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Cleaning air ducts, equipment, and terminal units.

1.04 REFERENCE STANDARDS

- A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017.
- B. ASHRAE Std 129 - Measuring Air-Change Effectiveness; 1997 (Reaffirmed 2002).
- C. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2016.
- D. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2010 (Reapproved 2018).
- E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- F. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; 1990.
- G. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; 1999.
- H. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.05 DEFINITIONS

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.06 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
 - 1. Submit not less than 60 days before enclosure of building.
 - 2. Identify potential sources of odor and dust.
 - 3. Identify construction activities likely to produce odor or dust.
 - 4. Identify areas of project potentially affected, especially occupied areas.
 - 5. Evaluate potential problems by severity and describe methods of control.
 - 6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
 - 7. Describe cleaning and dust control procedures.
 - 8. Describe coordination with commissioning procedures.

- C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.
- D. Duct and Terminal Unit Inspection Report.
- E. Air Contaminant Test Plan: Identify:
 - 1. Testing agency qualifications.
 - 2. Locations and scheduling of air sampling.
 - 3. Test procedures, in detail.
 - 4. Test instruments and apparatus.
 - 5. Sampling methods.
- F. Air Contaminant Test Reports: Show:
 - 1. Location where each sample was taken, and time.
 - 2. Test values for each air sample; average the values of each set of 3.
 - 3. HVAC operating conditions.
 - 4. Certification of test equipment calibration.
 - 5. Other conditions or discrepancies that might have influenced results.
- G. Ventilation Effectiveness Test Plan: Identify:
 - 1. Testing agency qualifications.
 - 2. Description of test spaces, including locations of air sampling.
 - 3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
 - 4. Test instruments and apparatus; identify tracer gas to be used.
 - 5. Sampling methods.
- H. Ventilation Effectiveness Test Reports: Show:
 - 1. Include preliminary tests of instruments and apparatus and of test spaces.
 - 2. Calculation of ventilation effectiveness, E.
 - 3. Location where each sample was taken, and time.
 - 4. Test values for each air sample.
 - 5. HVAC operating conditions.
 - 6. Other information specified in ASHRAE Std 129.
 - 7. Other conditions or discrepancies that might have influenced results.

1.07 QUALITY ASSURANCE

- A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Low VOC Materials: See Section 01 61 16.
- B. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.
- C. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
 - 1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
 - 2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
 - 3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.
- D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.
- E. HVAC equipment and supply air ductwork may be used for ventilation during construction:
 - 1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
 - 2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
 - 3. Do not use return air ductwork for ventilation unless absolutely necessary.
 - 4. Where return air ducts must be used for ventilation, install auxiliary filters at return inlets, sealed to ducts; use filters with at least the equivalent efficiency as those required at supply air side; inspect and replace filters when they lose efficiency.
- F. Do not store construction materials or waste in mechanical or electrical rooms.
- G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
 - 1. Inspect duct intakes, return air grilles, and terminal units for dust.
 - 2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
 - 3. Clean tops of doors and frames.
 - 4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
 - 5. Clean return plenums of air handling units.

6. Remove intake filters last, after cleaning is complete.
- H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.02 BUILDING FLUSH-OUT

- A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.
- B. Perform building flush-out before occupancy.
- C. Do not start flush-out until:
 1. All construction is complete.
 2. HVAC systems have been tested, adjusted, and balanced for proper operation.
 3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
 4. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
 5. New HVAC filtration media have been installed.
- D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.
 1. Obtain District's concurrence that construction is complete enough before beginning flush-out.
 2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.
 3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
 4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
 - a. Begin ventilation at least three hours prior to daily occupancy.
 - b. Continue ventilation during all occupied periods.
 - c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.
- E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.03 AIR CONTAMINANT TESTING

- A. Contractor's Option: Either full continuous flush-out, or satisfactory air contaminant testing is required, not both.
- B. Perform air contaminant testing before starting construction, as base line for evaluation of post-construction testing.
- C. Perform air contaminant testing before occupancy.
- D. Do not start air contaminant testing until:

1. All construction is complete, including interior finishes.
 2. HVAC systems have been tested, adjusted, and balanced for proper operation.
 3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
 4. New HVAC filtration media have been installed.
- E. Indoor Air Samples: Collect from spaces representative of occupied areas:
1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
 2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet; take samples from areas having the least ventilation and those having the greatest presumed source strength.
 3. Collect samples from height from 36 inches to 72 inches above floor.
 4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
 5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
 6. When retesting the same building areas, take samples from at least the same locations as in first test.
- F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.
- G. Analyze air samples and submit report.
- H. Air Contaminant Concentration Limits:
1. Comply with CalGreen Building Standards Section 5.504.4.5, Table 504.4.4.5 "Formaldehyde Limits".
 2. Formaldehyde: Not more than 16.3 parts per billion.
 3. PM10 Particulates: Not more than 20 micrograms per cubic meter.
 4. Comply with CalGreen Building Standards Section 5.504, Table 504.4.3 "VOC Content Limits for Architectural Coatings".
 5. Comply with CalGreen Building Standards Section 5.504, Table 504.4.1 "Adhesive VOC Limit" and Table 504.4.2 "Sealant VOC Limit".
 6. Total Volatile Organic Compounds (TVOCs): Not more than 200 micrograms per cubic meter.
 7. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: Allowable concentrations listed in Table 4-1.
 8. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
 9. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
 10. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

- I. Air Contaminant Concentration Test Methods:
 - 1. Formaldehyde: ASTM D5197, EPA 625/R-96/010b Method TO-11A, or EPA 600/4-90/010 Method IP-6.
 - 2. Particulates: EPA 600/4-90/010 Method IP-10.
 - 3. Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.
 - 4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625/R-96/010b Method TO-1, TO-15, or TO-17.
 - 5. Carbon Monoxide: EPA 600/4-90/010 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.
- J. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to District, or conduct full building flush-out specified above.

3.04 VENTILATION EFFECTIVENESS TESTING

- A. Perform ventilation effectiveness testing during commissioning period.
- B. Do not begin ventilation effectiveness testing until:
 - 1. HVAC testing, adjusting, and balancing has been satisfactorily completed.
 - 2. Building flush-out or air contaminant testing has been completed satisfactorily.
 - 3. New HVAC filtration media have been installed.
- C. Test each air handler zone in accordance with ASHRAE Std 129.
- D. If calculated air change effectiveness for a particular zone is less than 0.9 due to inadequate balancing of the system, adjust, and retest at no cost to District.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
 - 1. System Completeness.
 - 2. Installation of Products.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for District-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Identification of District-supplied products.
- B. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 40 00 - Quality Requirements: Product quality monitoring.
- D. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- E. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.
- F. Divisions 31 – 32: Sitework.

1.03 REFERENCE STANDARDS

- A. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
 - 1. Use California Electrical Code.

1.04 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.

- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.05 QUALITY ASSURANCE

- A. CAL (CDPH SM) v1.1: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1–2010, for the emissions testing and requirements of products and materials.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Drawings and Specifications:
 - 1. If a conflict exists between the Drawings and the Specifications (Project Manual), then the Contractor shall submit a Request for Interpretation from the Architect. See Section 01 30 00 - Administrative Requirements.
 - a. As noted in the General Conditions, the more stringent requirements shall govern, including cost of materials and/or installation.
 - 2. If a specific product is indicated on the Drawings for use, then that product shall be used without exception in the location identified.
 - 3. If the Contractor proposes the use of another product other than the item indicated, whether or not listed in these specifications, the Contractor shall submit the product using the complete substitution process. See the the Article titled "SUBSTITUTIONS".
 - 4. DSA (Division of the State Architect) approval is also required prior to the use or installation of any substitution, on any product or location of product (requiring a revision to the Drawings or Specifications), included in these construction documents.
 - a. Installation of a non-approved product may result in the Contractor removing and replacing the non-approved product at the Contractor's own expense. See Section 01 20 00 - Price and Payment Procedures.
- B. General: Items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock, and include materials, equipment, assemblies, fabrications and systems.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model designations indicated in the manufacturer's published product data.

2. **Materials:** Products that are shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed or installed to form a part of the Work.
 3. **Equipment:** A product with operating parts, whether motorized or manually operated, that requires connections such as wiring or piping.
- C. **Specific Product Requirements:** Refer to requirements of Section 01 40 00 - Quality Requirements and individual product Specifications Sections in Divisions 2 through 33 for specific requirements for products.
- D. **Minimum Requirements:** Specified requirements for products are minimum requirements. Refer to general requirements for quality of the Work specified in Section 01 40 00 - Quality Requirements and elsewhere herein.
- E. **Standard Products:**
1. Where specific products are not specified, provide standard products of types and kinds that are suitable for the intended purposes and that are usually and customarily used on similar projects under similar conditions.
 2. Products shall be as selected by Contractor and subject to review and acceptance by the District and Architect.
- F. **Product Completeness:**
1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
 2. Comply with additional requirements specified herein in Article titled "SYSTEM COMPLETENESS".
- G. **Code Compliance:**
1. All products, other than commodity products prescribed by Code, shall have a current ICC Evaluation Service Research Report (ICC ESR), CABO National Evaluation Report (NER), or other testing agencies as accepted by the Division of the State Architect.
 2. Refer to additional requirements specified in Section 01 41 00 - Regulatory Requirements.

2.02 SYSTEM COMPLETENESS

- A. The Contract Drawings and Specifications are not intended to be comprehensive directions on how to produce the Work. Rather, the Drawings and Specifications are instruments of service prepared to describe the design intent for the completed Work.
- B. It is intended that all equipment, systems and assemblies be complete and fully functional even though not fully described. Provide all products and operations necessary to achieve the design intent described in the Contract Documents.
- C. Refer to related general requirements specified in Section 01 41 00 - Regulatory Requirements regarding compliance with minimum requirements of applicable codes, ordinances and standards.
- D. **Omissions and Misdescriptions:** Contractor shall report to Architect immediately when elements essential to proper execution of the Work are discovered to be missing or misdescribed in the Drawings and Specifications or if the design intent is unclear.

1. Should an essential element be discovered as missing or misdescribed prior to receipt of Bids, an Addendum will be issued so that all costs may be accounted for in the Contract Sum.
2. Should an obvious omission or misdescription of a necessary element be discovered and reported after execution of the Agreement, Contractor shall provide the element as though fully and correctly described, and a no-cost Change Order shall be executed.
3. Refer to related General Conditions or general requirements specified in Section 01 30 00 - Administrative Requirements and 01 31 14 - Facility Services Coordination regarding construction interfacing and coordination.

2.03 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
 1. Provide products that fully comply with the Contract Documents, are undamaged and unused at installation.
 2. Comply with additional requirements specified herein in Article titled "PRODUCT OPTIONS".
- B. Use of products having any of the following characteristics is not permitted:
 1. Made outside the United States, its territories, Canada, or Mexico.
 2. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
 1. If used on interior, have lower emissions, as defined in Section 01 61 16.
 2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.
 3. Are extracted, harvested, and/or manufactured closer to the location of the project.
 4. Have longer documented life span under normal use.
 5. Result in less construction waste. See Section 01 74 19
- D. Provide interchangeable components of the same manufacture for components being replaced.
 1. To the fullest extent possible, provide products of the same kind from a single source. Products required to be supplied in quantity shall be the same product and interchangeable throughout the Work.
 2. When options are specified for the selection of any of two or more products, provide product selected to be compatible with products previously selected.
- E. Product Nameplates and Instructions:
 1. Except for required Code-compliance labels and operating and safety instructions, locate nameplates on inconspicuous, accessible surfaces. Do not attach manufacturer's identifying nameplates or trademarks on surfaces exposed to view in occupied spaces or to the exterior.
 2. Provide a permanent nameplate on each item of service-connected or power-operated equipment. Nameplates shall contain identifying information and essential operating data such as the following example:
 - a. Name of manufacturer

- b. Name of product
 - c. Model and serial number
 - d. Capacity
 - e. Operating and Power Characteristics
 - f. Labels of Tested Compliance with Codes and Standards
3. Refer to additional requirements which may be specified in various sections, as included in this Project Manual.
 4. For each item of service-connected or power-operated equipment, provide operating and safety instructions, permanently affixed and of durable construction, with legible machine lettering. Comply with all applicable requirements of authorities having jurisdiction and listing agencies.
- F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- G. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.04 PRODUCT OPTIONS

- A. Unless the specifications state that no substitution is permitted, whenever the Contract Documents indicate any specific article, device, equipment, product, material, fixture, patented process, form, method, or type of construction or any specific name, make, trade name, or catalog number, with or without the words "or equal," such specification shall be deemed to be used for the purpose of facilitating description of the material, process, or article desired and shall be deemed to be followed by the words "or equal."
1. See Section 01 25 00 - Substitution Procedures.
- B. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
1. Reference Standards:
 - a. Where Specifications require compliance with a standard, provided product shall fully comply with the standard specified.
 - b. Refer to general requirements specified in Section 01 42 19 - Reference Standards regarding compliance with referenced standards, standard specifications, codes, practices and requirements for products.
 2. Product Description:
 - a. Where Specifications describe a product, listing characteristics required, with or without use of a brand name, provide a product that has the specified attributes and otherwise complies with specified requirements.
 3. Performance Requirements:
 - a. Where Specifications require compliance with performance requirements, provide product(s) that comply and are recommended by the manufacturer for the intended application.
 - b. Verification of manufacturer's recommendations may be by product literature or by certification of performance from manufacturer.

- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- D. Products Specified by Identification of Manufacturer and Product Name or Number:
 - 1. "Specified Manufacturer": Provide the specified product(s) of the specified manufacturer.
 - a. If only one manufacturer is specified, without "acceptable manufacturers" being identified, provide only the specified product(s) of the specified manufacturer.
 - b. If District standard is indicated make all efforts to provide that product.
 - c. If the phrase "or equal" or "approved equal" is stated or reference is made to the "or equal provision," products of other manufacturers may be provided if such products are equivalent to the specified product(s) of the specified manufacturer.
 - 1) Equivalence shall be demonstrated by submission of information in compliance with requirements of Section 01 25 00 - Substitution Procedures.
 - 2. "Acceptable Manufacturers":
 - a. Product(s) of the named manufacturers, if equivalent to the specified product(s) of the specified manufacturer, will be acceptable in accordance with the requirements of Section 01 25 00 - Substitution Procedures.
 - 1) Exception: Considerations regarding changes in Contract Time and Contract Sum will be waived if no increase in Contract Time or Contract Sum results from use of such equivalent products.
 - 3. Unnamed manufacturers: Product(s) of unnamed manufacturers will be acceptable when disclosed during the bidding period and only as follows:
 - a. Unless specifically stated that substitutions will not be accepted or considered, the phrase "or equal" shall be assumed to be included in the description of specified product(s).
 - b. Equivalent products of unnamed manufacturers will be accepted in accordance with the "or equal" provision specified herein, below.
 - c. If provided, products of unnamed manufacturers shall be subject to the requirements of Section 01 25 00 - Substitution Procedures.
 - 4. Quality basis:
 - a. Specified product(s) of the specified manufacturer shall serve as the basis by which products by named acceptable manufacturers and products of unnamed manufacturers will be evaluated.
 - b. Where characteristics of the specified product are described, where performance characteristics are identified or where reference is made to industry standards, such characteristics are specified to identify the most significant attributes of the specified product(s) which will be used to evaluate products of other manufacturers.
- E. Products Specified by Combination of Methods: Where products are specified by a combination of attributes, including manufacturer's name, product brand name, product catalog or identification number, industry reference standard, or description of product characteristics, provide products conforming to all specified attributes.
- F. "Or Equal" Provision: Where the phrase "or equal" or the phrase "or approved equal" is included, equivalent product(s) of unnamed manufacturer(s) may be provided as specified

above in subparagraph titled "Unnamed manufacturers" and Section 01 25 00 - Substitution Procedures with the following conditions:

1. The requirements of Section 01 25 00 - Substitution Procedures shall apply to products provided under the "or equal" provision.
 - a. Exception: If the proposed product(s) are determined to be equivalent to the specified product(s) of the specified manufacturer, the requirement specified for substitutions to result in a net reduction in Contract Time or Contract Sum will be waived.
 2. Use of product(s) under the "or equal" provision shall not result in any delay in completion of the Work, including completion of portions of the Work for use by District or for work under separate contract by District.
 3. Use of product(s) under the "or equal" provision shall not result in any costs to the District, including design fees and permit and plan check fees.
 4. Use of product(s) under the "or equal" provision shall not require substantial change in the intent of the design, in the opinion of the Architect.
 - a. The intent of the design shall include functional performance and aesthetic qualities.
 5. The determination of equivalence will be made by the Architect and District, and such determination shall be final.
- G. Visual Matching:
1. Where Specifications require matching a sample, the decision by the Architect on whether a proposed product matches shall be final.
 2. Where no product visually matches but the product complies with other requirements, comply with provisions for substitutions for selection of a matching product in another category.
- H. Visual Selection of Products:
1. Where requirements include the phrase "as selected from manufacturer's standard colors, patterns and textures", or a similar phrase, selections of products will be made by indicated party or, if not indicated, by the Architect. The will select color, pattern and texture from the product line of submitted manufacturer, if all other specified provisions are met.
 2. The Architect will select color, pattern and texture from the product line of submitted manufacturer, if all other specified provisions are met.

2.05 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 25 00 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

- A. See Section 01 10 00 - Summary for identification of District-supplied products.
- B. District's Responsibilities:
 - 1. Arrange for and deliver District reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:
 - 1. Review District reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with District.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
 - 1. Schedule delivery to minimize long-term storage and prevent overcrowding construction spaces.
 - 2. Coordinate with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport products by methods to avoid product damage.
- F. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- G. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- H. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- I. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
 - 1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
- C. Inspection Provisions: Arrange storage to provide access for inspection and measurement of quantity or counting of units.
- D. Structural Considerations: Store heavy materials away from the structure in a manner that will not endanger supporting construction.
- E. Store and protect products in accordance with manufacturers' instructions.
- F. Store with seals and labels intact and legible.
- G. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- H. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- I. For exterior storage of fabricated products, place on sloped supports above ground.
 - 1. Place products on raised blocks, pallets or other supports, above ground and in a manner to not create ponding or misdirection of runoff.
- J. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- K. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
 - 1. Periodically inspect to ensure products are undamaged, and are maintained under required conditions.
 - 2. Remove and replace products damaged by improper storage or protection with new products at no change in Contract Sum or Contract Time.
 - 3. Weather-Resistant Storage:
 - a. Store moisture-sensitive products above ground, under cover in a weathertight enclosure or covered with an impervious sheet covering. Provide adequate ventilation to avoid condensation.
 - b. Maintain storage within temperature and humidity ranges required by manufacturer's instructions.
 - c. Store loose granular materials on solid surfaces in a well-drained area. Prevent mixing with foreign matter.
- L. Comply with manufacturer's warranty conditions, if any.
- M. Do not store products directly on the ground.
- N. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

- O. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- P. Prevent contact with material that may cause corrosion, discoloration, or staining.
- Q. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- R. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

3.05 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products, except where more stringent requirements are specified, are necessary due to Project conditions or are required by authorities having jurisdiction.
- B. Anchor each product securely in place, accurately located and aligned with other Work.
- C. Clean exposed surfaces and provide protection to ensure freedom from damage and deterioration at time of Substantial Completion review. Refer to additional requirements specified in General Conditions, Section 01 50 00 - Temporary Construction Facilities and Controls and 01 70 00 - Execution and Closeout Requirements.

3.06 PROTECTION OF COMPLETED WORK

- A. Provide barriers, substantial coverings and notices to protect installed Work from traffic and subsequent construction operations.
- B. Remove protective measures when no longer required and prior to Substantial Completion review of the Work.
- C. Comply with additional requirements specified in Section 01 50 00 - Temporary Construction Facilities and Controls.

END OF SECTION

SECTION 01 61 16
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Section 01 40 00 - Quality Requirements: Procedures for testing and certifications.
- C. Section 01 60 00 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- D. Section 07 92 00 - Joint Sealants: Emissions-compliant sealants.

1.03 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Flooring.
 - 4. Products making up wall and ceiling assemblies.
 - 5. Thermal and acoustical insulation.
 - 6. Other products when specifically stated in the specifications.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Exterior and interior paints and coatings.
 - 2. Exterior and interior adhesives and sealants, including flooring adhesives.
 - 3. Wet-applied roofing and waterproofing.
 - 4. Other products when specifically stated in the specifications.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
1. Concrete.
 2. Clay brick.
 3. Metals that are plated, anodized, or powder-coated.
 4. Glass.
 5. Ceramics.
 6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

- A. AHRI 340/360 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500 MM (12- to 60-in.) Diameter; 2013.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.
- E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.
- F. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- G. CRI (GL) - Green Label Testing Program - Certified Products; Current Edition.
- H. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.
- I. GreenSeal GS-36 - Adhesives for Commercial Use; 2013.
- J. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- K. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- L. SCS (CPD) - SCS Certified Products; Current Edition.
- M. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.
 1. Use the form following this section for installer certifications.

- D. Verification of compliance with VOC limits as specified in the CalGreen Code Section 5.504 shall be provided at the request of the Building Inspector.
 - 1. Product certification and specifications.
 - 2. Chain of custody certifications.
 - 3. Product, labeled and invoiced as meeting the Composite Wood Products regulation.
 - 4. Exterior grade products marked as meeting the PS-1 or PS-2 standards of the Engineered Wood Association, the Australian AS/NZS 2269 or European 636 3S standards
 - 5. Other methods approved by the building official.

1.06 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: AHRI 340/360 (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
 - c. Certification by manufacturer that product complies with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scs-certified.com.
 - b. Report of laboratory testing performed in accordance with requirements.
 - c. Published product data showing compliance with requirements.
 - d. Certification by manufacturer that product complies with requirements.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.07 REGULATORY REQUIREMENTS

- A. All VOC restricted products shall be compliant with local jurisdiction, South Coast Air Quality Management District, Air Pollution Control District, County of San Diego, and California Green Standards Code, Rules and Regulations in effect at the time of installation. Products specified in this project shall be used as a basis of design. Updated products that are compliant with the rules in force at the time of installation shall be submitted as substitutions when they become available.
 - 1. If a product is found to be non-compliant with the VOC rules at the scheduled time of installation, notify the Architect a minimum of 90 days prior to installation. Contractor shall submit a suggested compliant product that is equal to the performance and cost of the specified product using the substitution procedure described in section 01 60 00 - Product Requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
 - 1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
 - a. Comply with CalGreen Building Standards Section 5.504.4.5, Table 504.4.4.5 "Formaldehyde Limits".
 - 2. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Aerosol Adhesives: GreenSeal GS-36.
 - 3. Joint Sealants: SCAQMD 1168 Rule.
 - 4. Paints and Coatings: Each color; most stringent of the following:
 - a. AHRI 340/360.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - d. CalGreen Building Standards Section 5.504, Table 504.4.3 "VOC Content Limits for Architectural Coatings".
 - 5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.
 - 6. Clear Wood Finishes, Floor Coatings, Stains, Primers and Shellacs: Do not exceed the VOC content limits established in 1 rule.
 - 7. Carpet, Carpet Tile, and Adhesive: Provide products having VOC content not greater than that required for 1 certification.

- a. Comply with CalGreen Building Standards Section 5.504, Table 504.4.1 "Adhesive VOC Limit".
- 8. Carpet Cushion: Provide products having VOC content not greater than that required for 1 certification.
 - a. Comply with CalGreen Building Standards Section 5.504, Table 504.4.1 "Adhesive VOC Limit".
- D. Other Product Categories: Comply with limitations specified elsewhere.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. District reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to District.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 61 16.01

ACCESSORY MATERIAL VOC CONTENT CERTIFICATION FORM

.01 FORM

A. Identification:

1. Project Name: Imperial Valley College – DSPS MODULAR
2. Project No.: 19-43100-00
3. Architect: SGH Architects

B. Use of This Form:

1. Because installers are allowed and directed to choose accessory materials suitable for the applicable installation, there is a possibility that such accessory materials might contain VOC content in excess of that permitted, especially where such materials have not been explicitly specified.
 - a. Each installer of work on this project is required to certify that his/their use of these particular materials complies with the contract documents and to provide documentation showing that the products used do not contain the prohibited content.
2. Contractor is required to obtain and submit this form from each installer of work on this project.
3. For each product category listed, check the correct paragraph.
4. If any of these accessory materials has been used, attach to this form product data and MSDS sheet for each such product.

C. VOC content restrictions are specified in Section 01 61 16.

1. Volatile organic compounds (VOCs) are defined by the U.S. EPA, California Air Resources Board (CARB), South Coast Air Quality Management District (SCAQMD), along with other state and local regulations applicable to this project.

1.01 PRODUCT CERTIFICATION

A. I certify that the installation work of my firm on this project:

1. [HAS] [HAS NOT] required the use of any ADHESIVES.
2. [HAS] [HAS NOT] required the use of any JOINT SEALANTS.
3. [HAS] [HAS NOT] required the use of any PAINTS OR COATINGS.
4. [HAS] [HAS NOT] required the use of any COMPOSITE WOOD or AGRIFIBER PRODUCTS.

B. Product data and MSDS sheets are attached.

- C. ___ Adhesives: I certify that the installation work of my firm on this project has not required the use of any adhesives.
OR (certify either the above or the below, not both)
- D. ___ Adhesives: I certify that my firm has NOT installed any adhesive with VOC content exceeding that specified in Sections 01 60 00 and on this project; product data and MSDS sheets for all adhesives used, whether specified or not, are attached.
- E. ___ Joint Sealants: I certify that the installation work of my firm on this project has not required the use of any gunnable or pourable joint sealants.
OR (certify either the above or the below, not both)
- F. ___ Joint Sealants: I certify that my firm has NOT installed any joint sealant with VOC content exceeding that specified in Section 07 92 00 - Joint Sealants on this project; product data and MSDS sheets for all joint sealants used, whether specified or not, are attached.
- G. ___ Coatings: I certify that the installation work of my firm on this project has not required the use of any coatings.
OR (certify either the above or the below, not both)
- H. ___ Coatings: I certify that my firm has NOT installed any adhesive with VOC content exceeding that specified in Sections 01 60 00 and on this project; product data and MSDS sheets for all coatings used, whether specified or not, are attached.
- I. ___ Composite Wood and Agrifiber Products: I certify that the work of my firm on this project has not required the use of any composite wood or agrifiber products, as defined above.
OR (certify either the above or the below, not both)
- J. ___ Composite Wood and Agrifiber Products: I certify that the composite wood and agrifiber products, as defined above, furnished or installed by my firm DO NOT contain any ADDED urea-formaldehyde binder; product data and MSDS sheets for products used, whether specified or not, are attached.

2.01 CERTIFIED BY: (INSTALLER/MANUFACTURER/SUPPLIER FIRM)

- A. Firm Name: _____
- B. Print Name: _____
- C. Signature: _____
- D. Title: _____ (officer of company)
- E. Date: _____

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of District personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 33 00 - Submittals procedures.
- C. Section 01 31 14 - Facility Services Coordination: Coordination of trades and BIM documents.
- D. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- E. Section 01 45 33 - Code Required Special Inspections & Procedures: Construction oversight procedures by DSA regarding the execution, approval, and closeout of this building project.
- F. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.
- G. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.
- H. Section 01 74 19 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- I. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- J. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- K. Section 02 41 00 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.
- L. Section 02 84 00 - Polychlorinate Biphenyl (PCB) Remediation: Removal of equipment containing substances regulated under the Federal Toxic Substances Control Act (TSCA), including but not limited to PCB- and mercury-containing equipment.

- M. Section 07 84 00 - Firestopping.
- N. Individual Product Specification Sections:
 - 1. Advance notification to other sections of openings required in work of those sections.
 - 2. Limitations on cutting structural members.

1.03 REFERENCE STANDARDS

- A. CFC Ch. 35 - California Fire Code - Chapter 35 - Welding and Other Hot Work; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of District or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work. Include shop drawings as necessary to identify locations and communicate descriptions.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Effect on work of District or separate Contractor.
 - f. Effect on existing construction of District and, if applicable, work for Project being provided by District under separate contract.
 - g. Written permission of affected separate Contractor.
 - h. Date and time work will be executed.
 - 7. Include written evidence that those performing work under separate contract for District have been notified and acknowledge that cutting and patching work will be occurring. Include written permission for intended cutting and patching, included scheduled times.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
 - 1. Minimum of 5 years of documented experience.
- B. For surveying work, employ a land surveyor registered in California and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in California. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.
- D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in California.

1.06 PROJECT CONDITIONS

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water.
- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
 - 2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
- G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

- H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

- A. See Section 01 10 00 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After District occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of District's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.
- D. Temporary Supports: Provide supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- E. Weather Protection: Provide protection from elements for areas which may be exposed by uncovering Work. Maintain excavations free of water.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
 - 1. Coordinate operations of the various trades to assure efficient and orderly installation of each part of Work.
 - 2. Coordinate Work operations of the various trades that depend on each other for proper installation, connection, and operation of Work, including but not limited to:
 - a. Schedule construction operations in sequence required where installation of one part of Work depends on installation of other components, before or after its own installation.
 - b. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 - c. Provide provisions to accommodate items scheduled for later installation.
 - 3. Prepare and administer coordination drawings. Refer to Section 01 31 14 - Facility Services Coordination.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, District, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Notify the District at least 48 hours before staking is to be started.
- B. Verify locations of survey control points prior to starting work.
- C. Promptly notify Architect of any discrepancies discovered.
- D. Contractor shall locate and protect survey control and reference points.
- E. Control datum for survey is that established by District provided survey.
- F. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- G. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- H. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- I. Utilize recognized engineering survey practices.
- J. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- K. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- L. Periodically verify layouts by same means.
- M. Maintain a complete and accurate log of control and survey work as it progresses.
- N. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Dimensions for Accessibility:
 - 1. Conventions: See CBC Figure 11B-104. Dimensions that are not stated as "maximum" or "minimum" are absolute.
 - 2. Tolerances shall be per CBC 11B-104.1.1 "Construction and manufacturing tolerances. All dimensions are subject to conventional industry tolerances except where the requirement is stated as a range with specific minimum and maximum end points."
- B. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- C. When welding or doing other hot work, comply with CFC Ch. 35.
- D. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

- E. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- F. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- G. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- H. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 .
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on drawings.
 - 3. Relocate items indicated on drawings.
 - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
 4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
 - 1. Coordinate installation or application of products for integrated Work.
 - 2. Uncover completed Work as necessary to install or apply products out of sequence.
 - 3. Remove and replace defective or non-conforming Work.
 - 4. Provide openings for penetration of utility services, such as plumbing, mechanical and electrical Work.
- E. After uncovering existing Work, inspect conditions affecting proper accomplishment of Work.
- F. Temporary Supports: Provide supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- G. Beginning of cutting or patching shall be interpreted to mean that existing conditions were found by Contractor to be acceptable.
- H. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- I. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
 - 1. Use a diamond grit abrasive saw or similar cutter for smooth edges. Do not overcut corners.
- J. Restore work with new products in accordance with requirements of Contract Documents.
- K. Fit work neat and tight allowing for expansion and contraction.
- L. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- M. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- N. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 2. Match color, texture, and appearance.
 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
- O. Finishing: Refinish surfaces to match adjacent and similar finishes as used for the Project.
1. For continuous surfaces, refinish to nearest intersection or natural break.
 2. For an assembly, refinish entire unit.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 PROJECT CLOSEOUT CONFERENCE

- A. Schedule and conduct a project closeout conference, at a time convenient to District and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
 - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of District, Commissioning Authority (CxA), Architect, and relevant consultants; Contractor and project superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Commissioning.
 - c. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - d. Submittal of written warranties.
 - e. Coordination of separate contracts.
 - f. District's partial occupancy requirements.
 - g. Installation of District's furniture, fixtures, and equipment.
 - h. Responsibility for removing temporary facilities and controls.
 - 4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, District, participants, and those affected by decisions made.

3.12 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 79 00 - Demonstration and Training.

3.13 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

3.14 FINAL CLEANING

- A. Cleaning and Disposal Requirements, General: Conduct cleaning and disposal operations in compliance with all applicable codes, ordinances and regulations, including environmental protection laws, rules and practices.
- B. Execute final cleaning prior to final project assessment.
 - 1. Clean areas to be occupied by District prior to final completion before District occupancy.
- C. Substantial Completion Review Cleaning, General: Execute a thorough cleaning prior to Substantial Completion review by Architect and District. Employ experienced workers or professional cleaners for cleaning operations for Substantial Completion review.
- D. Use cleaning materials that are nonhazardous.
 - 1. Cleaning Agents and Materials: Use only those cleaning agents and materials which will not create hazards to health or property and which will not damage or degrade surfaces.
 - a. Use only those cleaning agents, materials and methods recommended by manufacturer of the material to be cleaned.
 - b. Use cleaning materials only on surfaces recommended by cleaning agent manufacturer.
 - c. Before use, review cleaning agents and materials with Construction Manager for suitability and compatibility. Use no cleaning agents and materials without approval as noted above.
 - 2. Cleaning Procedures: All cleaning processes, agents and materials shall be subject to Architect, District and/or Construction Manager review and approval. Processes and degree of cleanliness shall be as directed by Architect, District and/or Construction Manager.
- E. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- F. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- G. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- H. Clean filters of operating equipment.
- I. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- J. Clean site; sweep paved areas, rake clean landscaped surfaces.
- K. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.15 CLOSEOUT PROCEDURES

- A. Clean-Up Retainage:
 - 1. Five (5) percent of each Contractor's bid will automatically be held in abeyance in their contract schedule of values for clean-up.

2. If in the Construction Manager's opinion the Contractor is maintaining a clean project, a pro-rata share of this clean-up budget will be paid monthly to the Contractor in accordance with their approximate aggregate percentage of completion of the project.
 3. If a Contractor fails to heed written directives to clean-up during the course of the project, the work will be done at the Contractor's expense and a deductive change order will be written against their contract with the District.
 4. The establishment of this 5 percent budget in no way limits the cost for the Contractor to maintain a clean project.
- B. Make submittals that are required by governing or other authorities.
1. Provide copies to Architect and District.
- C. Accompany Architect, Construction Manager, and District Representative on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's comprehensive list of items to be completed or corrected.
1. As authorized by the District; Architect and Architect's and District's consultants, as appropriate, will attend a meeting at the Project site to review Contract closeout procedures and to review the list of items to be completed and corrected (punch list) to make the Work ready for acceptance by the District.
 2. This meeting shall be scheduled not earlier than 14 days prior to the date anticipated for the Substantial Completion review.
- D. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- E. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
1. Final Application for Payment: In the Application for Payment that coincides with the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed substantially complete.
 2. Warranties, Bonds and Certificates: Submit specific warranties, guarantees, workmanship bonds, maintenance agreements, final certifications and similar documents.
 3. Locks and Keys: Change temporary lock cylinders over to permanent keying and transmit keys to the District, unless otherwise directed or specified.
 4. Tests and Instructions: Complete start-up testing of systems, and instruction of the District's personnel. Remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- F. Clearing and Cleaning: Prior to the Substantial Completion review, Contractor shall conduct a thorough cleaning and clearing of the Project area, including removal of construction facilities and temporary controls.

- G. Inspection and Testing: Prior to the Substantial Completion review, complete inspection and testing required for the Work, including securing of approvals by authorities having jurisdiction.
1. Complete all inspections, tests, balancing, sterilization and cleaning of plumbing and HVAC systems.
 2. Complete inspections and tests of electrical power and signal systems.
 3. Complete inspections and tests of conveying (elevator or wheelchair lift) systems.
- H. District will occupy all of the building as specified in Section 01 10 00.
- I. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
1. Correction (Punch) List: Contractor shall prepare and distribute at the preliminary Contract closeout review meeting, a typewritten, comprehensive list of items to be completed and corrected (punch list) to make the Work ready for acceptance by the District.
 - a. The punch list shall include all items to be completed or corrected prior to the Contractor's application for final payment.
 - b. The punch list shall identify items by location (room number or name) and consecutive number. For example, 307-5 would identify item 5 in Room 307, Roof-4 would identify item 4 on Roof.
 - c. Contractor shall prepare separate lists according to categories used for Drawings. For example, provide lists for Architectural, Structural, Plumbing, Mechanical, Electrical, Fire Protection, Civil, and Landscape.
 - d. Architect, Architect's consultants and District's consultants, if in attendance, will conduct a brief walk-through of Project with the Contractor to review scope and adequacy of the punch list.
 - e. Verbal comments will be made to the Contractor by the Construction Manager, the Architect and the Architect's and District's consultants, if in attendance, during the walk-through. These comments will indicate generally the additions and corrections to be made to the punch list. Such comments shall not be considered to be comprehensive; Contractor shall use the comments as guidance in preparing the punch list for the Substantial Completion review.
 2. Substantial Completion Meeting: On a date mutually agreed by the District, Architect, and Contractor, a meeting shall be conducted at the Project site to determine whether the Work is satisfactory and complete for filing a Notice of Completion (Substantial Completion).
 - a. Contractor shall provide three working days notice to Architect for requested date of Substantial Completion meeting.
 - b. The Construction Manager, the Architect and the Architect's and District's consultants, as authorized by the District, will attend the Substantial Completion meeting.
 - c. In addition to conducting a walk-through of the facility and reviewing the punch list, the purpose of the meeting shall include submission of warranties, guarantees and bonds to the District, submission of operation and maintenance data (manuals),

- provision of specified extra materials to the District, and submission of other Contract closeout documents and materials as required and if not already submitted.
- d. The Construction Manager, the Architect and Architect's consultants, as appropriate, will conduct a walk-through of the facility with the Contractor and review the punch list.
 - e. Contractor shall correct the punch list and record additional items as may identified during the walk-through, including notations of corrective actions to be taken.
 - f. Contractor shall retype the punch list and distribute it within three working days to those attending the meeting.
 - g. If additional site visits by the Construction Manager, the Architect and the Architect's and District's consultants are required to review completion and correction of the Work, the costs of additional visits shall be reimbursed to the District by the Contractor by deducting such costs from the Final Payment.
- J. Correct items of work listed in Final Correction Punch List and comply with requirements for access to District-occupied areas.
 - K. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
 - 1. Architect's Certification of Substantial Completion:
 - a. When Architect determines that list of items to be completed and corrected (Punch List) is sufficiently complete for District to occupy Project for the use to which it is intended.
 - b. Architect will complete and issue to the District and Contractor a Certificate of Substantial Completion using:
 - 1) The American Institute of Architects Form G704 - Certificate of Substantial Completion
 - 2) or other form if directed by the District.
 - L. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.16 FINAL PAYMENT

- A. After completion of all items listed for completion and correction, after submission of all documents and products and after final cleaning, submit final Application for Payment, identifying total adjusted Contract Sum, previous payments and sum remaining due.
- B. Payment will not be made until the following are accomplished:
 - 1. All Project Record Documents have been transferred and accepted by District.
 - 2. All extra materials and maintenance stock have been transferred and received by District.
 - 3. All warranty documents and operation and maintenance data have been received and accepted by District.
 - 4. All liens have been released or bonded by Contractor.
 - 5. Contractor's surety has consented to Final Payment.
 - 6. All documentation required by DSA has been completed.

3.17 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the District.

END OF SECTION

SECTION 01 71 23
FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Field engineering services by Contractor.
- B. Land surveying services by Contractor.

1.02 DESCRIPTION OF SERVICES

- A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.
- B. Sole responsibility for establishing all locations, dimensions and levels of items of work.
- C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.
- D. Having a skilled instrument person(s) available on short notice when necessary for laying out the work.
- E. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.
- F. Provision of facilities and assistance necessary for Architect to check lines and grade points placed by Contractor.
 - 1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by Architect.
- G. Preparation and maintenance of daily reports of activity on the work. Submission of reports containing key progress indicators and job conditions to Architect.
 - 1. Number of employees at the Site.
 - 2. Number employees at the Site for each of Contractor's subcontractors.
 - 3. Breakdown of employees by trades.
 - 4. Major equipment and materials installed as part of the work.
 - 5. Major construction equipment utilized.
 - 6. Location of areas in which construction was performed.
 - 7. Materials and equipment received.
 - 8. Work performed, including field quality control measures and testing.
 - 9. Weather conditions.
 - 10. Safety.
 - 11. Delays encountered, amount of delay incurred, and the reasons for the delay.

- 12. Instructions received from Architect or District, if any.
- H. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.
- I. Prior to backfilling operations, surveying - locating, and recording on a copy of Contract Documents - an accurate representation of buried work and Underground Facilities encountered.
- J. Setting up and executing time-lapse photography of construction activities.

1.03 REFERENCE STANDARDS

- A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology; 1998.
- B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks; 1998.
- C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement; 2002.
- D. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.
- E. State Plane Coordinate System for California.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Submit in addition to items required in Section 01 70 00 - Execution and Closeout Requirements.
- C. Informational Submittals: Submit the following:
 - 1. Field Engineering: Submit daily reports, with content as indicated in this section.
 - a. When requested by Architect, submit for Record documentation verifying accuracy of field engineering including, but not limited to, Contractor's survey notes and field notes.
 - 2. Final property survey.

1.06 QUALITY ASSURANCE

- A. Field Engineer's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.
- B. Land Surveyor's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.
- C. Use adequate number of skilled and thoroughly-trained workers to perform the work of this section in a timely and comprehensive manner.
- D. Minimum accuracy for required work is as follows:

1. Grade: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
2. Culverts and ditches: Horizontal Tolerance: Plus or minus 0.5 feet, Vertical Tolerance: Plus or minus 0.05 feet.
3. Structures: Horizontal Tolerance: Plus or minus 0.5 feet (location), Vertical Tolerance: Plus or minus 0.05 feet.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. Notify District's Representative and Architect of any discrepancies immediately in writing before proceeding to lay out the work. Locate and protect existing benchmarks and base line. Preserve permanent reference points during construction.
- B. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existing conditions.

3.02 FIELD ENGINEERING

- A. Maintain field office files, drawings, specifications, and record documents.
- B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.
- C. Prepare layout and coordination drawings for construction operations.
- D. Check and coordinate the work for conflicts and interferences, and immediately advise Architect and District of all discrepancies of which Contractor is aware.
- E. Cooperate as required with Architect and District in observing the work and performing field inspections.
- F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.
- G. In general, match existing adjacent grades and maintain existing flow lines.
- H. Check the location, line and grade of every major element as the work progresses. Notify the Architect when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule for remedying the deviation. Do not proceed with remedial work without District's concurrence of the remediation plan.
- I. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment for compliance with shop drawings and Contract Documents requirements.
- J. Check all bracing and shoring for structural integrity and compliance with designs prepared by the Contractor.

3.03 LAND SURVEYING

- A. General: Follow standards for geospatial positioning accuracy.
 - 1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
 - 2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.
 - 3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.
- B. Coordinate survey data with the State Plane Coordinate System of California.
- C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor's expense by a surveyor licensed in California, and approved by the Architect.
 - 1. Temporarily suspend work at such points and for such reasonable times as the District may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.

3.04 CONSTRUCTION SURVEYING

- A. General: Perform surveying as applicable to specific items necessary for proper execution of work.
 - 1. Alignment Staking: Provide alignment stakes at 50 foot intervals on tangent, and at 25 foot intervals on curves.
 - 2. Slope Staking: Provide slope staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. Re-stake at every ten-foot difference in elevation.
 - 3. Structure: Stake out structures, including elevations, and check prior to and during construction.
 - 4. Pipelines: Stake out pipelines including elevations, and check prior to and during construction.
 - 5. Site Utilities: Stake out utility lines including elevations, and check prior to and during construction.
 - 6. Road: Stake out roadway elevations at 50 foot intervals on tangent, and at 25 foot intervals on curves.
 - 7. Cross-sections: Provide original, intermediate, and final staking as required, for site work and other locations as necessary for quantity surveys.
 - 8. Easement Staking: Provide easement staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. If required by project conditions, provide wooden laths with flagging at 100 foot intervals.
 - 9. Record Staking: Provide permanent stake at each blind flange and each utility cap is provided for future connections. Use stakes for record staking of material(s) acceptable to Architect.
 - 10. Structural Frame: Upon completion, certify location and plumbness.
- B. Surveying to Determine Quantities for Payment.

1. For each application for progress payment, perform such surveys and computations necessary to determine quantities of work performed or placed. Perform surveys necessary for Architect to determine final quantities of work in place.
 2. Notify Architect at least 24 hours before performing survey services for determining quantities. Unless waived in writing by Architect, perform quantity surveys in presence of Architect.
- C. Record Log: Maintain a log of layout control work. Record any deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used.
- D. Use by the Architect: The Architect may at any time use line and grade points and markers established by the Contractor. The Contractor's surveys are a part of the work and may be checked by the Architect at any time.
- E. Accuracy:
1. Establish Contractor's temporary survey references points for Contractor's use to at least second-order accuracy (e.g., 1:10000). Set construction staking used as a guide for the work to at least third-order accuracy (e.g., 1:5000). Provide the absolute margin for error specified below on the basis established by such orders.
 - a. Horizontal accuracy of easement staking: Plus or minus 0.1 feet.
 - b. Accuracy of other staking shall be plus or minus 0.04 feet horizontally and plus or minus 0.02 feet vertically.
 - c. Include an error analysis sufficient to demonstrate required accuracy in survey calculations.
 2. District reserves the right to check the Contractor's survey, measurements, and calculations. The requirement for accuracy will not be waived, whether this right is exercised or not.

3.05 SUPPORT AND BRACING

- A. General requirements: Design all support and bracing systems, if required. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design systems to not overstress the building structure.
- B. Seismic Bracing: Design where required by authorities having jurisdiction.
1. Design and install all support systems to comply with the seismic requirements of the Construction Code of California.
 2. Design and install seismic bracing so as not to defeat the operation on any required vibration isolation or sound isolation devices.
 3. For seismic bracing guidelines for mechanical, electrical and plumbing systems, refer to SMACNA (SRM).

3.06 REPORTS

- A. Submit two copies of Contractor's daily reports at Architect's field office (or electronically) by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.

3.07 RECORDS

- A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.
 - 1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in California. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records,(including field books) may be rejected by District due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.
 - 2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Architect.
- B. Submit three copies of final property survey to District. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:
 - 1. Structure locations from property lines, and distances to adjacent buildings.
 - 2. Dimensions and locations of drives, walks, walls, underground utilities, appurtenances, and major site features.
 - 3. Location of easements.
 - 4. Final grading topographic survey.

3.08 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Comply with the requirements Section 5.408 of the California Green Building Standards Code.
 - 1. Recycle and/or salvage for reuse a minimum of 65percent of the nonhazardous construction and demolition waste in accordance with Section 504.8.1.1, 5.408.1.2, or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent.
- B. District requires that this project generate the least amount of trash and waste possible.
- C. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- D. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood.
 - 5. Comply with California Green Code (CGC) 5.408.3; Excavated soil and land clearing debris: 100 percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled.
 - a. Exception: Reuse, either on-or off-site, of vegetation or soil contaminated by disease or pest infestation.
 - 6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
 - 7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
 - 8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
 - 9. Asphalt paving: May be recycled into paving for project.
 - 10. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 11. Glass.
 - 12. Gypsum drywall and plaster.

13. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (<http://flooring.dupont.com>) and Interface (www.interfaceinc.com) conduct reclamation programs.
 14. Roofing.
 15. Paint.
 16. Plastic sheeting.
 17. Rigid foam insulation.
 18. Windows, doors, and door hardware.
 19. Plumbing fixtures.
 20. Mechanical and electrical equipment.
 21. Fluorescent lamps (light bulbs).
 22. Acoustical ceiling tile and panels.
 23. Materials which could be hazardous and subject to special disposal regulations include but are not limited to the following: CalGreen Section 5.408.2
 - a. Lead-Based Paint
 - b. Asbestos: Found in older pipe insulation, asphalt floor tiles, linoleum, insulation, etc.
 - c. Polychlorinated Biphenyls (PCBs):
 - 1) Found in electrical oil filled equipment manufactured prior to 1978 such as transformers, switches and fluorescent lamp ballasts.
 - 2) Also found in adhesive, sealant, caulk, glazing putty, roofing material, pesticide vehicle, ink, paper, fabric dye, gaskets, and hydraulic fluid.
 - d. HVAC Refrigerants: Containing Fluorinated and Chlorinated compounds.
 - e. Drinking Fountain Refrigerants: Containing Fluorinated and Chlorinated compounds.
 - f. Fluorescent Light Tubes: Contain mercury.
 - g. EXIT signs and Smoke Detectors: May contain unregulated, radioactive tritium. Required to be returned to manufacturer.
 - h. Contaminated Soils.
 - i. Pressure Treated Lumber.
- F. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
1. Contractor's quantitative reports for construction waste materials as a condition of approval of progress payments.
- G. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements. CalGreen Section 5.408.1.1.
- H. The following sources may be useful in developing the Waste Management Plan:
1. California Recycling Department, at www.bsc.ca.gov/Home/CALGreen.aspx.
 2. General information contacts regarding construction and demolition waste:
 - a. EPA Construction and demolition (C&D) debris website: www.epa.gov/epawaste/conserves/imr/cdm/.

- b. Directory of Wood-Framed Building Deconstruction and Reused Building Materials Companies: www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr150.pdf.
 - c. Additional resources to be developed by Contractor with assistance from District and Contractor, as requested.
3. Recycling Haulers and Markets: The source list below contains local haulers and markets for recyclable materials. This list is provided for information only and is not necessarily comprehensive; other haulers and markets are acceptable.
- a. CAL-MAX: www.calrecycle.ca.gov/calmax/.
 - 1) A free service designed to help businesses find markets for non-hazardous materials they have traditionally discarded.
 - b. General Recycling/Reuse Centers: For information on qualified local solid waste haulers contact the California Department of Resources Recycling and Recovery - CalRecycle. The website lists wastes recycling facilities in counties throughout the State of California.
 - 1) <http://www.calrecycle.ca.gov/default.asp>
- I. Methods of trash/waste disposal that are not acceptable are:
- 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
 - 5. Incineration, either on- or off-site.
- J. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 50 00 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 60 00 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 70 00 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
 - 1. Debris that is not hazardous as defined in CalGreen Section 5.408.2 and California Code of Regulations, Title 22, Section 66261.3 et seq.

2. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel.
 3. The debris may be commingled with rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Diversion: Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste-to-energy processes.
- E. Enforcement Agency (EA). Enforcement agency as defined in CA Public Resources Code 40130.
- F. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- G. Landfill, Inert waste or Inert Disposal Facility:
1. A disposal facility that accepts only inert waste such as soil and rock, fully cured asphalt paving, uncontaminated concrete (including fiberglass or steel reinforcing rods embedded in the concrete), brick, glass, and ceramics, for land disposal.
- H. Landfill, Class III:
1. A landfill that accepts non-hazardous resources such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations.
 2. A Class III landfill must have a solid waste facilities permit from the California Integrated Waste Management Board (CIWMB) and is regulated by the Enforcement Agency (EA).
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A processing facility that accepts loads of commingled construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing the non-recyclable residual materials.
- K. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- L. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- M. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- N. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- O. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

- P. Recycling Center: A facility that receives only C&D material that has been separated for reuse prior to receipt, in which the residual (disposed) amount of waste in the material is less than 10% of the amount separated for reuse by weight.
- Q. Return: To give back reusable items or unused products to vendors for credit.
- R. Reuse: To reuse a construction waste material in some manner on the project site.
- S. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- T. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- U. Separated for Reuse:
 - 1. Materials, including commingled recyclables.
 - 2. Separated or kept separate from the solid waste stream for the purpose of:
 - a. Additional sorting or processing those materials for reuse or recycling.
 - 1) In order to return them to the economic mainstream in the form of raw material for new, reused, or reconstituted products.
 - b. Products shall meet the quality standards necessary to be used in the marketplace.
 - c. Includes materials that have been "source separated".
- V. Solid Waste:
 - 1. All putrescible and nonputrescible solid, semisolid, and liquid wastes, including:
 - a. Garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes.
 - b. Abandoned vehicles and parts thereof.
 - c. Discarded home and industrial appliances.
 - d. Dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste.
 - e. Manure, vegetable or animal solid and semisolid wastes.
 - f. Other discarded solid and semisolid wastes.
 - 2. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by State law.
- W. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
 - 1. Materials, including commingled recyclables, that have been separated or kept separate from the solid waste stream at the point of generation, for the purpose of additional sorting or processing of those materials for reuse or recycling in order to return them to the economic mainstream in the form of raw materials for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace.
- X. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- Y. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- Z. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

- AA. Waste Hauler: A company that possesses a valid permit from the local waste management authority to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal in the locality.

1.04 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Submit Waste Management Plan within 30 calendar days after receipt of Notice to Proceed, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
 - 1. Submit four copies of CWMP for review.
 - a. Contractor's Construction Waste and Recycling Plan must be approved by the Architect and Construction Manager prior to the start of Work.
 - 2. Approval of the Contractor's CWMP shall not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.
- C. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - a. List each material proposed to be salvaged, reused, or recycled.
 - b. List the local market for each material.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
 - 7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.
- D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - a. Inert materials shall achieve a construction waste diversion rate of at least 95 percent.

- 1) These materials include, but are not limited to, concrete, asphalt and rock.
 - 2) Earthwork is not included.
 - 3) Excavated soil shall not be included in any of the calculations used to ensure compliance with this specification section.
 - b. The overall diversion rate must be based on weight.
 - c. The diversion rate of individual materials can be measured in either weight or volume, but the rate shall be converted into the units selected for calculating the overall diversion rate.
 - 1) All individual material diversions must be converted to a consistent set of units when calculating the overall diversion rate for the all reports and submittals required for the Work.
 - d. Conversion rate numbers shall be based on standard conversion rate data for construction projects provided by the California Integrated Waste Management Board (CIWMB). This data is available at the following internet location, <http://www.calrecycle.ca.gov/LGCentral/Library/dsg/ICandD.htm>.
2. Submit Report on a form acceptable to District.
 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 5. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
 6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 01 60 00 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 60 00:
 - 1. Relative amount of waste produced, compared to specified product.
 - 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 - 3. Proposed disposal method for waste product.
 - 4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, District, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Prebid meeting.
 - 2. Preconstruction meeting.
 - 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.

- b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
- 2. Provide containers as required.
- 3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
- 4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
- 5. Locate enclosures out of the way of construction traffic.
- 6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
- 7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
- 8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

3.03 DISPOSAL OPERATIONS AND WASTE HAULING

- A. Remove waste materials from Project Site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except for items or materials to be salvaged, recycled, or otherwise reused.
 - 2. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on site.
 - 3. Use a permitted waste hauler or Contractor's trucking services and personnel. To confirm valid permitted status of waste haulers, contact the local solid waste authority.
 - 4. Become familiar with the conditions for acceptance of new construction, excavation and demolition materials at recycling facilities, prior to delivering materials.
 - 5. Deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, composting, or disposal.
 - 6. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 7. Do not burn or bury waste materials on or off site. Appropriate on-site topical application of ground gypsum or wood, or use of site paving as granulated fill is considered reuse, not waste.

3.04 PLAN AND REPORT FORMS

- A. See suggested forms on the following pages.

END OF SECTION

CONTRACTOR'S CONSTRUCTION WASTE AND RECYCLING PLAN

(Submit After Award of Contract and Prior to Start of Work)

Project Title:						
Contract or Work Order No.:						
Contractor's Name:						
Street Address:						
City:			State:		Zip:	
Phone: ()			Fax: ()			
E-Mail Address:						
Prepared by: (Print Name)						
Date Submitted:						
Project Period: From: TO:						
Reuse, Recycling or Disposal Processes To Be Used						
Describe the types of recycling processes or disposal activities that will be used for material generated in the project. Indicate the type of process or activity by number, types of materials, and estimated quantities that will be recycled or disposed in the sections below:						
01 - Reuse of building materials or salvage items on site (i.e. crushed base or red clay brick)						
02 - Salvaging building materials or salvage items at an offsite salvage or re-use center (i.e. lighting, fixtures)						
03 - Recycling source separated materials on site (i.e. crushing asphalt/concrete for reuse or grinding for mulch)						
04 - Recycling source separated materials at an offsite recycling center (i.e. scrap metal or green materials)						
05 - Recycling commingled loads of C&D materials at an offsite mixed debris recycling center or transfer station						
06 - Recycling material as Alternative Daily Cover at landfills						
07 - Delivery of soils or mixed inerts to an inert landfill for disposal (inert fill).						
08 - Disposal at a landfill or transfer station.						
09 - Other (please describe) _____						
Types of Material To Be Generated						
Use these codes to indicate the types of material that will be generated on the project						
A = Asphalt C = Concrete M = Metals I = Mixed Inert G = Green Materials						
D = Drywall P/C=Paper/Cardboard W/C = Wire/Cable S= Soils (Non Hazardous)						
M/C = Miscellaneous Construction Debris R = Reuse/Salvage W = Wood O = Other (describe)						
Facilities Used: Provide Name of Facility and Location (City)						
Total Truck Loads: Provide Number of Trucks Hauled from Site During Reporting Period						
Total Quantities: If scales are available at sites, report in tons. If not, quantify by cubic yards. For salvage/reuse items, quantify by estimated weight (or units).						
SECTION I - RE-USED/RECYCLED MATERIALS						
Include all recycling activities for source separated or mixed material recycling centers where recycling will occur.						
Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities		
				Tons	Cubic YD	Other Wt.
(ex.) M	04	ABC Metals, Los Angeles	24	355		
a. Total Diversion						

CONTRACTOR'S CONSTRUCTION WASTE AND RECYCLING PLAN

Continued

SECTION II - DISPOSED MATERIALS						
Include all disposal activities for landfills, transfer stations, or inert landfills where no recycling will occur.						
Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities		
				Tons	Cubic YD	Other Wt.
(ex.) D	08	DEF Landfill, Los Angeles	2	35		
b. Total Disposal				0	0	0

SECTION III - TOTAL MATERIALS GENERATED			
This section calculates the total materials to be generated during the project period (Reuse/Recycle + Disposal = Generation)			
	Tons	Cubic YD	Other Wt.
a. Total Reused/Recycled	0	0	0
b. Total Disposed	0	0	0
c. Total Generated	0	0	0

SECTION IV - CONTRACTOR'S LANDFILL DIVERSION RATE CALCULATION			
Add totals from Section I + Section II			
	Tons	Cubic YD	Other Wt.
a. Materials Re-Used and Recycled	0		
b. Materials Disposed	0		
c. Total Materials Generated (a. + b. = c.)	0	0	0
d. Landfill Diversion Rate (Tonnage Only)*			

* Use tons only to calculate recycling percentages: Tons Reused/Recycled/Tons Generated = % Recycled

Contractor's Comments (Provide any additional information pertinent to planned reuse, recycling, or disposal activities):

- Notes:
- | | |
|--|--|
| 1. Suggested Conversion Factors: From Cubic Yards to Tons
(Use when scales are not available) | c. Ferrous Metals: .22 (ex. 1000 CY Ferrous Metal = 220 tons) |
| a. Asphalt: .61 (ex. 1000 CY Asphalt = 610 tons. Applies to broken chunks of asphalt) | d. Non-Ferrous Metals: .10 (ex. 1000 CY Non-Ferrous Metals = 100 tons) |
| b. Concrete: .93 (ex. 1000 CY Concrete = 930 tons. Applies to broken chunks of concrete) | e. Drywall Scrap: .20 |
| | f. Wood Scrap: .16 |

CONTRACTOR'S REUSE, RECYCLING, AND DISPOSAL REPORT

(Submit With Each Progress Payment)

Project Title:						
Contract or Work Order No.:						
Contractor's Name:						
Street Address:						
City:				State:		Zip:
Phone: ()				Fax: ()		
E-Mail Address:						
Prepared by: (Print Name)						
Reuse, Recycling or Disposal Processes to Be Used						
Describe the types of recycling processes or disposal activities that will be used for material generated in the project. Indicate the type of process or activity by number, types of materials, and estimated quantities that will be recycled or disposed in the sections below:						
01 - Reuse of building materials or salvage items on site (i.e. crushed base or red clay brick)						
02 - Salvaging building materials or salvage items at an offsite salvage or re-use center (i.e. lighting, fixtures)						
03 - Recycling source separated materials on site (i.e. crushing asphalt/concrete for reuse or grinding for mulch)						
04 - Recycling source separated materials at an offsite recycling center (i.e. scrap metal or green materials)						
05 - Recycling commingled loads of C&D materials at an offsite mixed debris recycling center or transfer station						
06 - Recycling material as Alternative Daily Cover at landfills						
07 - Delivery of soils or mixed inerts to an inert landfill for disposal (inert fill).						
08 - Disposal at a landfill or transfer station.						
09 - Other (please describe) _____						
Types of Material To Be Generated						
Use these codes to indicate the types of material that will be generated on the project						
A = Asphalt C = Concrete M = Metals I = Mixed Inert G = Green Materials						
D = Drywall P/C=Paper/Cardboard W/C = Wire/Cable S= Soils (Non-Hazardous)						
M/C = Miscellaneous Construction Debris R = Reuse/Salvage W = Wood O = Other (describe)						
Facilities Used: Provide Name of Facility and Location (City)						
Total Truck Loads: Provide Number of Trucks Hauled from Site During Reporting Period						
Total Quantities: If scales are available at sites, report in tons. If not, quantify by cubic yards. For salvage/reuse items, quantify by estimated weight (or units).						
SECTION I - RE-USED/RECYCLED MATERIALS						
Include all recycling activities for source separated or mixed material recycling centers where recycling will occur.						
Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities		
				Tons	Cubic YD	Other Wt.
(ex.) M	04	ABC Metals, Los Angeles	24	355		
a. Total Diversion						

CONTRACTOR'S REUSE, RECYCLING, AND DISPOSAL REPORT

Continued

SECTION II - DISPOSED MATERIALS						
Include all disposal activities for landfills, transfer stations, or inert landfills where no recycling will occur.						
Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities		
				Tons	Cubic YD	Other Wt.
(ex.) D	08	DEF Landfill, Los Angeles	2	35		
b. Total Disposal						

SECTION III - TOTAL MATERIALS GENERATED			
This section calculates the total materials to be generated during the project period (Reuse/Recycle + Disposal = Generation)			
	Tons	Cubic YD	Other Wt.
a. Total Reused/Recycled			
b. Total Disposed			
c. Total Generated			

SECTION IV - CONTRACTOR'S LANDFILL DIVERSION RATE CALCULATION			
Add totals from Section I + Section II			
	Tons	Cubic YD	Other Wt.
a. Materials Re-Used and Recycled			
b. Materials Disposed			
c. Total Materials Generated (a. + b. = c.)			
d. Landfill Diversion Rate (Tonnage Only)*			

* Use tons only to calculate recycling percentages: Tons Reused/Recycled/Tons Generated = % Recycled

Contractor's Comments (Provide any additional information pertinent to planned reuse, recycling, or disposal activities):

- Notes:
- | | |
|--|--|
| 1. Suggested Conversion Factors: From Cubic Yards to Tons
(Use when scales are not available) | c. Ferrous Metals: .22 (ex. 1000 CY Ferrous Metal = 220 tons) |
| a. Asphalt: .61 (ex. 1000 CY Asphalt = 610 tons. Applies to broken chunks of asphalt) | d. Non-Ferrous Metals: .10 (ex. 1000 CY Non-Ferrous Metals = 100 tons) |
| b. Concrete: .93 (ex. 1000 CY Concrete = 930 tons. Applies to broken chunks of concrete) | e. Drywall Scrap: .20 |
| | f. Wood Scrap: .16 |

SECTION 01 76 10
TEMPORARY PROTECTIVE COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary protective coverings for installed floors, walls, and other surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 01 70 00 - Execution and Closeout Requirements: Coordination of requirements for materials specified in this section.

1.03 REFERENCE STANDARDS

- A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.
- B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2012, with Editorial Revision (2017).
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018b.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- E. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.

1.04 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes available; and installation instructions.
- C. Shop Drawings: Indicate existing finished surfaces to be protected.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Temporary Protective Coverings:
 - 1. Fortifiber Building Systems Group: fortifiber.com.
 - 2. Protex Products: www.protex-products.com.
 - 3. Surface Shields, Inc: www.surfaceshields.com.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GENERAL

- A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
 - 1. Water resistant.
 - 2. Vapor permeable.

3. Impact resistant.
4. Slip resistant.
5. Flame retardant.

2.03 MATERIALS

A. Sheet Materials:

1. Corrugated polypropylene sheet.
2. Recycled paperboard/plastic composite sheet.
3. Recycled paperboard sheet.
4. Wood Hardboard: ANSI A135.4, tempered, 1/4 inch thick nominal.
5. Plywood, 1/2 inch thick nominal.
6. Fiberboard: ASTM C208, 1/2 inch thick nominal.
7. Water Vapor Permeability: Greater than 0.1 perms when tested in accordance with 1.
8. Flame Retardance: Meet requirements of NFPA 701.
9. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

B. Rolled Materials:

1. Self-adhering polyethylene film.
2. Recycled cellulose fiberboard paper.
3. Laminated glass fiber reinforced kraft paper.
4. Rosin coated paper.
5. Water Vapor Permeability: Greater than 0.1 perms when tested in accordance with 1.
6. Flame Retardance: Meet requirements of NFPA 701.
7. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

C. Corner and Door Jamb Protection Materials:

1. Cardboard, shaped specifically for application.
2. PVC plastic.

D. Tape: Type recommended by protective covering material manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

- A. Remove dirt and debris from surfaces to be protected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Trim or overlap sheet materials to fit area to be covered.

- C. Roll out and cut rolled materials to fit area to be covered.
- D. Tape seams. Avoid taping directly to finished surfaces.
- E. Stretch self-adhering film materials to completely cover surface.
- F. Install door jamb protection to full height of opening.
- G. Position corner protection 4 inches above finished floor to 96 inches high.

3.03 REMOVAL

- A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section District issued Bidding Instructions and General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 45 33 - Code Required Special Inspections & Procedures: Construction oversight procedures by DSA regarding the execution, approval, and closeout of this building project.
- D. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- E. Individual Product Sections: Specific requirements for operation and maintenance data.
- F. Individual Product Sections: Warranties required for specific products or Work.
 - 1. Special Project warranty requirements for specific products or elements of the Work; commitments and agreements for continuing services to District.

1.03 DEFINITIONS

- A. Warranty: Assurance to District by Contractor, installer, supplier, manufacturer or other party responsible as warrantor, for the quantity, quality, performance and other representations of a product, system service of the Work, in whole or in part, for the duration of the specified period of time.
- B. Guarantee: Assurance to District by Contractor or product manufacturer or other specified party, as guarantor, that the specified warranty will be fulfilled by the guarantor in the event of default by the warrantor.
- C. Standard Product Warranty: Preprinted, written warranty published by product manufacturer for particular products and specifically endorsed by the manufacturer to the District.
- D. Special Project Warranty: Written warranty required by or incorporated into Contract Documents, to extend time limits provided by standard warranty or to provide greater rights for District.
- E. Correction Period: As defined in the Conditions of the Contract, Correction Period shall be synonymous with "warranty period", "guarantee period" and similar terms used in the Contract Specifications.

1.04 SUBMITTALS

- A. Advance Submittals: For equipment and systems, or component parts of systems, put into service during construction and operated by District, submit documents within ten days of start of operation by District.
- B. Final Completion Submittals: Prior to application for final payment, Contractor shall submit 3 copies the following:
 - 1. Agency Document Submittals: Submit to District all documents required by authorities having jurisdiction, including serving utilities and other agencies. Submit original versions of all permit cards, with final sign-off by inspectors. Submit all certifications of inspections and tests.
 - a. Contractor shall also complete all required contractor forms and obtain DSA approval of these same forms. Comply with "Final Certification of Construction" per Title 24 Part 1 section 4-339.
 - 1) Form-6.C: Verified Report – Contractor: From each Contractor having a contract with the District.
 - 2. Final Specifications Submittals: Submit to District all documents and products required by Specifications to be submitted, including the following:
 - a. Project record drawings and specifications.
 - b. Operating and maintenance data.
 - c. Guarantees, warranties and bonds.
 - d. Spare parts and extra stock.
 - e. Test reports and certificates of compliance.
 - 3. Certificates of Compliance and Test Report Submittals: Submit to District certificates and reports as specified and as required by authorities having jurisdiction, including the following:
 - a. Sterilization of water systems.
 - b. Gas system tests.
 - c. Lighting, power and signal system tests.
 - d. Ventilation equipment and air balance tests.
 - e. Roofing inspections and tests.
 - 4. Lien and Bonding Company Releases: Submit to District, with copy to Architect, evidence of satisfaction of encumbrances on Project by completion and submission of The American Institute of Architects Forms:
 - a. G706 - Contractor's Affidavit of Payment of Debts and Claims;
 - b. G706A - Contractor's Affidavit of Release of Liens;
 - c. (if applicable) G707 - Consent of Surety;
 - d. or forms as as agreed to by the District.
 - e. Comply also with other requirements of District, as directed.
 - f. All signatures shall be notarized.
 - 5. Subcontractor List: Submit to two copies to District and two copies to Architect of updated Subcontractor and Materials Supplier List.

6. Warranty Documents: Prepare and submit to District all warranties and bonds as specified in Contract General Conditions and this Section.
- C. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
 - D. Operation and Maintenance Data:
 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 2. For equipment, or component parts of equipment put into service during construction and operated by District, submit completed documents within ten days after acceptance.
 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
 - E. Warranties and Bonds:
 1. For equipment or component parts of equipment put into service during construction with District's permission, submit documents within 10 days after acceptance.
 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

1.05 WARRANTIES AND GUARANTEES

- A. General:
 1. Provide all warranties and guarantees with District named as beneficiary.
 2. For equipment and products, or components thereof, bearing a manufacturer's warranty or guarantee that extends for a period of time beyond the Contractor's warranty and guarantee, so state in the warranty or guarantee.
- B. Provisions for Special Warranties: Refer to Conditions of the Contract for terms of the Contractor's special warranty of workmanship and materials.
- C. General Warranty and Guarantee Requirements:
 1. Warranty shall be an agreement to repair or replace, without cost and undue hardship to District, Work performed under the Contract which is found to be defective during the Correction Period (warranty or guarantee) period.
 2. Repairs and replacements due to improper maintenance or operation, or due to normal wear, usage and weathering are excluded from warranty requirements unless otherwise specified.
- D. Specific Warranty and Guarantee Requirements: Specific requirements are included in product Specifications Sections of Divisions 3 through 32, including content and limitations.
- E. Disclaimers and Limitations:

1. Manufacturer's disclaimers and limitations on product warranties and guarantees shall not relieve Contractor of responsibility for warranty and guarantee requirements.
 2. This applies to the Work that incorporates such products, nor shall they relieve suppliers, manufacturers, and installers required to countersign special warranties with Contractor.
- F. Related Damages and Losses: When correcting warranted Work that has been found defective, remove and replace other Work that has been damaged as a result of such defect or that must be removed and replaced to provide access for correction of warranted Work.
- G. Reinstatement of Warranty:
1. When Work covered by a warranty has been found defective and has been corrected by replacement or rebuilding, reinstate the warranty by written endorsement.
 2. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- H. Replacement Cost:
1. Upon determination that Work covered by a warranty has been found to be defective, replace or reconstruct the Work to a condition acceptable to District, complying with applicable requirements of the Contract Documents.
 2. Contractor shall be responsible for all costs for replacing or reconstructing defective Work regardless of whether District has benefited from use of the Work through a portion of its anticipated useful service life.
- I. District's Recourse:
1. Written warranties made to the District shall be in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under law, nor shall warranty periods be interpreted as limitations on time in which the District can enforce such other duties, obligations, rights, or remedies.
 2. Rejection of Warranties:
 - a. The District reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- J. Warranty as Condition of Acceptance:
1. District reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment shall be required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Record Documents are to be maintained and submitted in searchable live electronic format (PDF).
1. Develop in compliance with Section 01 30 00 - Administrative Requirements.

2. Acceptable markup software:
 - a. Adobe Acrobat Professional.
 - b. Bluebeam Revu.
- B. Maintain on site one set of the following record documents; record actual revisions to the Work:
 1. Contract Drawings.
 2. Project Manual with Specifications.
 3. Addenda.
 4. Change Orders and other modifications to the Contract.
 5. Reviewed shop drawings, product data, and samples.
 6. Manufacturer's instruction for assembly, installation, and adjusting.
- C. Ensure entries are complete and accurate, enabling future reference by District.
- D. Store record documents separate from documents used for construction.
- E. Record information concurrent with construction progress.
- F. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and modifications.
 4. Provide copies of all approved addenda, directives, corrections, and change orders affecting the associated project.
 - a. These copies shall be included with the "Bid Set" and/or "Record Set" listed above and formatted as detailed above.
- G. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Reproducible set of Contract Drawings will be provided to Contractor by District through Architect or Construction Manager.
 2. Measured depths of foundations in relation to finish first floor datum.
 3. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 5. Field changes of dimension and detail.
 6. Details not on original Contract drawings.
 - a. Application of copies of details produced and provided by Architect during construction will be accepted.
- H. Submission: Submit Record Documents in searchable (live text and redlines mark-ups; not scanned) PDF format to Architect prior to final Application for Payment.

1. Maintain one additional paper copy and one in PDF format (on CD) of the fire suppression and fire protection detection system drawings and specifications at the building premises.
 - a. One copy is to be kept on site for a period of three years to comply with CFC section 901.6.2.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.
 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - 1. Parts Data:
 - a. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams as necessary for service and maintenance.
 - b. Include complete nomenclature and catalog numbers for consumable and replacement parts.
 - c. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in stock by the District or operator.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for District's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
 - 1. Provide duplicate electronic formatted (PDF) versions of the O&M binder for record purposes. Organize the same as the printed versions.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.
 - 4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with District's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Project Warranty and Guarantee Forms:
 - 1. Example forms for special Project warranties and guarantees are included at the end of this Section.
 - 2. Prepare written documents utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, supplier or manufacturer.
 - a. Submit a draft to District through Architect for approval prior to final execution.
 - 3. Refer to product Specifications Sections of Divisions 2 through 33 for specific content requirements, and particular requirements for submittal of special warranties.

4. Prepare standard warranties and guarantees, excepting manufacturers' standard printed warranties and guarantees, on Contractor's, subcontractor's, material supplier's, or manufacturer's own letterhead, addressed to District.
 5. Warranty and guarantee letters shall be signed by all responsible parties and by Contractor in every case, with modifications only as approved in advance by District to suit the conditions pertaining to the warranty or guarantee.
- C. Manufacturer's Guarantee Form:
1. Manufacturer's guarantee form may be used in lieu of special Project form included at the end of this Section.
 2. Manufacturer's guarantee form shall contain appropriate terms and identification, ready for execution by the required parties.
 3. If proposed terms and conditions restrict guarantee coverage or require actions by District beyond those specified, submit draft of guarantee to District through Architect for review and acceptance before performance of the Work.
 4. In other cases, submit draft of guarantee to District through Architect for approval prior to final execution of guarantee.
- D. Signatures: Signatures shall be by person authorized to sign warranties, guarantees and bonds on behalf of entity providing such warranty, guarantee or bond.
- E. Co-Signature: All installer's warranties and bonds shall be co-signed by Contractor. Manufacturer's guarantees will not require co-signature.
- F. Verify that documents are in proper form, contain full information, and are notarized.
- G. Co-execute submittals when required.
- H. Retain warranties and bonds until time specified for submittal.
- I. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- J. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
1. If more than one volume of warranties, guarantees and bonds is produced, identify volume number on binder.
- K. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- L. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- M. Form of Warranty and Bond Submittals:
1. Prior to final Application and Certificate for Payment, compile two copies of each required warranty, guarantee and bond, properly executed by Contractor, or jointly by Contractor, subcontractor, supplier, or manufacturer.

2. Collect and assemble all written warranties and guarantees into binders and deliver binders to District for final review and acceptance.
3. Include Table of Contents for binder, neatly typed, following order and Section numbers and titles as used in the Project Manual.
4. Provide heavy paper dividers with celluloid or plastic covered tabs for each separate warranty.
 - a. Mark tabs to identify products or installation, and Section number and title.
5. Include on separate typed sheet, if information is not contained in warranty or guarantee form, a description of the product or installation, and the name, address, telephone number and responsible person for applicable installer, supplier and manufacturer.
6. When operating and maintenance data manuals are required for warranted construction, include additional copies of each required warranty and guarantee in each required manual.
 - a. Coordinate with requirements listed in the prior articles for operating and maintenance data manuals.

3.07 TIME OF WARRANTY AND BOND SUBMITTALS

- A. Submission of Preliminary Copies:
 1. Unless otherwise specified, obtain preliminary copies of warranties, guarantees and bonds within ten days of completion of applicable item or Work.
 2. Prepare and submit preliminary copies for review as specified herein.
- B. Submission of Final Copies:
 1. Submit fully executed copies of warranties, guarantees and bonds within ten days of date identified in Certificate of Completion but no later than three days prior to date of final Application for Payment.
- C. Date of Warranties and Bonds:
 1. Unless otherwise directed or specified, commencement date of warranty, guarantee and bond periods shall be the date established in the Certificate of Completion.
 2. Warranties for Work accepted in advance of date stated in Certificate of Completion:
 - a. When a designated system, equipment, component parts or other portion of the Work is completed and occupied or put to beneficial use by District:
 - 1) By separate agreement with Contractor, prior to completion date established in the Certificate of Completion, submit properly executed warranties to District within ten days of completion of that designated portion of the Work.
 - 2) List date of commencement of warranty, guarantee or bond period as the date established in the Certificate of Completion.
 3. Warranties for Work not accepted as of date established in the Certificate of Completion:
 - a. Submit documents within ten days after acceptance, listing date of acceptance as beginning of warranty, guarantee or bond period.
- D. Duration of Warranties and Guarantees:
 1. Unless otherwise specified or prescribed by law, warranty and guarantee periods shall be not less than the Correction Period required by the Conditions of the Contract.

2. In no case, the period is to be less than one year from the date established for completion of the Project in the Certificate of Completion.
3. See product Specifications Sections of the Project Manual for extended warranty and guarantee beyond the minimum one year duration.

END OF SECTION

**SECTION 01 78 00.01
WARRANTY FORM LETTER**

FOR CONTRACTOR'S / SUBCONTRACTOR'S / MANUFACTURER'S WARRANTY

CONTRACTOR'S/SUBCONTRACTOR'S/SUPPLIER'S LETTERHEAD

SPECIAL LIMITED PROJECT WARRANTY FOR _____ WORK.

We, the undersigned, do hereby warrant that the portion of the Work described above which we have provided for Leffingwell ES Modernization is in accordance with the Contract Documents and that all such Work as installed will fulfill or exceed all minimum warranty requirements. We agree to repair or replace Work installed by us, together with any adjacent Work which is displaced or damaged by so doing, that proves to be defective in workmanship, material, or function within a period of (years), commencing (date identified in Certificate of Completion, unless otherwise directed) and terminating (date).

The following terms and conditions apply to this warranty (obtain District 's approval before submission):

In the event of our failure to comply with the above-mentioned conditions within a reasonable time period determined by the District , after notification in writing, we, the undersigned, all collectively and separately, hereby authorize the District to have said defective Work repaired or replaced to be made good, and agree to pay to the District upon demand all moneys that the District may expend in making good said defective Work, including all collection costs and reasonable attorney fees.

LOCAL REPRESENTATIVE: FOR WARRANTY MAINTENANCE, REPAIR, OR REPLACEMENT SERVICE, CONTACT:

(Name) _____
(Address) _____
(City) _____ (State) _____ (ZIP) _____
(Phone) _____ / _____
(signed) _____
(Date) _____ (Typed Name) _____
(Title) _____ (Firm) _____

CONTRACTOR:

State License No: _____
(signed) _____
(Date) _____ (Typed Name) _____
(Title) _____ (Firm) _____

FORM LETTER

FORM LETTER

FOR CONTRACTOR'S / MANUFACTURER'S GUARANTEE

CONTRACTOR'S / MANUFACTURER'S LETTERHEAD

SPECIAL LIMITED PROJECT [__WARRANTY__] [__GUARANTEE__] FOR _____ WORK.

We, the undersigned, do hereby [__warrant__] [__guarantee__] that the portion of the Work described above which [__we have provided__] [__was provided by (Installer or Subcontractor's Name)__] for Leffingwell ES Modernization in accordance with the Contract Documents and that all such Work as installed will fulfill or exceed all minimum warranty requirements. We agree to repair or replace Work installed by [__us,__] [__(Installer or Subcontractor's Name)__] together with any adjacent Work which is displaced or damaged by so doing, that proves to be defective in workmanship, material, or function within a period of (years), commencing (date indicated in Certificate of Completion, unless otherwise directed) and terminating (date).

The following terms and conditions apply to this [__warranty__] [__guarantee__] (obtain District's approval before submission):

In the event of our failure to comply with the above-mentioned conditions within a reasonable time period determined by the District, after notification in writing, we, the undersigned, all collectively and separately, hereby authorize the District to have said defective Work repaired or replaced to be made good, and agree to pay to the District upon demand all moneys that the District may expend in making good said defective Work, including all collection costs and reasonable attorney fees.

LOCAL REPRESENTATIVE: FOR WARRANTY MAINTENANCE, REPAIR, OR REPLACEMENT SERVICE, CONTACT:

(Name) _____
(Address) _____
(City) _____ (State) _____ (ZIP) _____
(Phone) _____ / _____
(signed) _____
(Date) _____ (Typed Name) _____
(Title) _____ (Firm) _____

CONTRACTOR:

State License No: _____
(signed) _____
(Date) _____ (Typed Name) _____
(Title) _____ (Firm) _____

FORM LETTER

END OF SECTION

**SECTION 02 05 00
DEMOLITION AND SALVAGE**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall provide demolition and removal of existing structural materials, vegetation, utility facilities, miscellaneous equipment, facilities and structures within the property boundary of the new DSPS Modular Building Project in accordance with the requirements of the Contract Documents and as illustrated on the Demolition Plan, Sheet 2 of Grading and Improvement Plans.

- B. The Contractor shall repair or replace, without cost to the Owner and to the satisfaction of the Engineer, existing facilities disturbed or damaged during demolition and removal operations.

- C. An existing tree in conflict with the new DSPS Modular Building shall be removed and replanted at a location specified by the Imperial Valley College (IVC) project manager.

- D. Existing irrigation lines and sprinklers in conflict with the new DSPS Building shall be identified by the contractor and shall be removed and disposed. Dead end irrigation lines shall be capped. Contractor to provide as-built drawings of removed irrigation lines and sprinklers.

- E. Immediately upon removal of demolition items, the Contractor shall legally dispose of demolished items not to be salvaged. Demolished items not to be salvaged shall be removed from the Site within two (2) calendar days of the commencement of demolition activities. ***Unless noted in the Plans, the Owner reserves the right to salvage any of the existing material or equipment. The Contractor, upon being notified by the Engineer, shall salvage and relocate to an Owner-designated, on-site storage area any materials or equipment the Owner desires to keep. The cost of the removal and relocation of the items shall be included in the contract price.*** No demolished items shall be sold while on the Owner's property.

END OF SECTION 02 05 00

SECTION 02 15 00
SHEETING, SHORING AND BRACING

PART 1 - GENERAL

1.01 DESCRIPTION

This section provides requirements for sheeting, shoring, bracing, wales, posts, piling, anchorages and fastenings or other excavation supports, both temporary or permanent, for accomplishment and protection of Work.

1.02 QUALITY ASSURANCE

A. Design Requirements:

In accordance with Section 6500 of the Labor Code, the Contractor is required to obtain a permit, for the excavation of trench which is five feet (5') or more in depth and into which a person is required to descend, from the Division of Industrial Safety.

The Contractor shall furnish all labor, equipment and materials required to design, construct and remove all sheeting, shoring and bracing or other equivalent method of support for the walls of open excavations required for the construction of this project.

Excavation of any trench, pad area, foundation area, or structure five feet (5') or more in depth shall not commence until the Contractor has received approval from the Engineer of the Contractor's detailed plan for worker protection from the hazards of trench or soil wall collapse/failure.

Such plan shall be submitted at least five (5) days before the Contractor intends to begin excavation and shall show the details of the design of shoring, bracing, sloping or other provisions to be made for worker protection during such excavation. No such plan shall allow the use of shoring, sloping or a protective system less effective than that required by the Construction Safety Orders of the Division of Industrial Safety. The plan shall be prepared and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California.

Prior to the beginning of excavations requiring shoring, the Contractor shall designate in writing to the Engineer, the person responsible to supervise the project safety measures and the person responsible to supervise the installation and removal of sheeting, shoring and bracing.

In addition to shoring the excavations in accordance with minimum requirements of the Industrial Safety Orders, it shall be the Contractor's responsibility to provide any and all additional shoring required to support the sides of the excavation against the effects of loads which may exceed those derived by using the criteria set forth in the Industrial Safety Orders. The Contractor shall be solely responsible for any damages which may result from his failure to provide adequate shoring to support the excavation under any or all of the conditions of grading which may exist, or which may arise during the construction of the project.

B. Material Standards:

Furnish lumber for shores, wales, and sheeting of grading required by the American Lumber Standards for the particular application.

1.03 SUBMITTALS

Contractor shall submit complete calculations of the sheeting system including sizing of sheeting wales, rakers, anchor system, struts, earth anchors, anchor piles, tie rods or any other components pertinent to the design prior to the start of any Work involving sheeting and bracing. All designs submitted shall be stamped and signed by an Engineer with a Civil or Structural designation with an active registration in the State of California.

1.04 JOB CONDITIONS

Buried debris may be found at some locations. Federal and local agency requirements for safety of job personnel and public will apply to work under the Section.

1.05 ALTERNATIVES

The use of application of alternative methods and materials, and the employment of proprietary systems under lease or franchise in lieu of that specified herein, may be allowed. Demonstration of suitability and compliance with these Specifications will be required. The application of alternative methods will be approved by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber:

1. Temporary Shores, Wales and Sheeting: Furnish structural grade planks, beams and posts as defined and specified for stress-grade lumber in the American Lumber Standards. Lumber may be rough, untreated, in random lengths, and shall be of standard dimensions.
2. Permanent Sheeting: When permanent sheeting is called for on the Drawings, provide and install planks, beams, posts and timers of unseasoned, rough, new southern yellow pine or Douglas Fir meeting the requirements of ASTM Standard D25, Class "C". In lieu of the above, lumber dressed to standard dimensions, dried and treated in accordance with Standard T-3 of the American Wood Preservers' Association may be utilized.

B. Fastenings:

Provide fastenings for permanent sheeting as recommended in the National Design Specification for stress-grade lumber and its fastening.

PART 3 - EXECUTION

3.01 INSTALLATION

Install sheeting and bracing for trench and structure excavation progressively as the removal of excavated material requires. Butt planks to exclude groundwater and fines, preventing the erosion of voids outside sheeting. In soft, wet ground drive sheeting to a lower level as excavation progresses to that sheeting is embedded in undisturbed earth. Bracing of sheet piling may be permitted to penetrate the structural concrete only as directed by the Owner. Refer to Section 03300 – Cast-in-Place Concrete. Install wales and struts at close intervals so as to prevent displacement of the surrounding earth and to maintain safe conditions in the Work area. Any damage proven to result from improper installations shall be the responsibility of the Contractor. Temporary sheeting for trench and structure excavation may be removed and reused. Withdraw individual planks alternately as the backfill is raised, maintaining sufficient sheeting and bracing to protect the Work and workmen. Remove bracing completely. Where unstable conditions occur in the underlying strata from any cause, and withdrawal of sheeting will endanger the Work, a portion of the sheeting, including bracing, may be left in place with the approval of the Owner. Remove all wood within a zone extending four feet (4') below finished grade. Leaving such material in place shall not be cause for an increase in the contract price. The use of horizontal strutting below the barrel of a pipe or the use of a pipe as support will not be permitted. Sheet piling and timers in trench excavations shall be withdrawn in a manner so as to prevent subsequent settlement of the pipe or additional backfill loadings which might overload the pipe. Trench sheeting below the top of the pipe shall be left in place.

END OF SECTION 02 15 00

SECTION 02 41 00 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 10 00 - Summary: Description of items to be removed by District.
- C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- G. Section 07 01 50.19 - Preparation for Re-Roofing: Removal of existing roofing, roof insulation, flashing, trim, and accessories.
- H. Section 31 23 23 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

- A. AHRI 560 - Voluntary Specification for Rotary Operators in Window Applications; 2010.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 DEFINITIONS

- A. Remove: Remove and legally dispose of items, except those identified for use in recycling, re-use, and salvage programs.
- B. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human or animal life; affect other species of importance to humanity; or degrade the utility of the environment for aesthetic, cultural or historical purposes.
- C. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively for the purpose of disposal.
 - 1. Inert Solids/Inert Waste: Non-liquid solid waste including, but not limited to, soil and concrete, that does not contain hazardous substances or soluble pollutants at

concentrations in excess of water-quality standards established by a regional water board and does not contain significant quantities of decomposable solid waste.

- D. Class III Landfill: A landfill that accepts non-hazardous materials such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A Class III landfill must have a solid waste facilities permit from the State of California.
- E. Demolition Waste: Building materials and solid waste resulting from construction, remodeling, repair, cleanup, or demolition operations that are not hazardous. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing material, ceramic tile, carpeting, plastic pipe, and steel. The materials may include rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.
- F. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.
- G. Recycling: The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
- H. Reuse: The use, in the same or similar form as it was produced, of a material which might otherwise be discarded.
- I. Solid Waste: All putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by State law.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Construction Conference: Conduct a pre-construction conference one week prior to the start of the work of this section; require attendance by all affected trades.
- B. Convene a conference at the Project site 3 days prior to starting demolition to review the Drawings and Specifications, requirements of authorities having jurisdiction, instructions and requirements of serving utilities, sequencing and interface considerations and project conditions.
- C. Conference shall be attended by Construction Manager, supervisory and quality control personnel of Contractor and all subcontractors performing this and directly-related Work.
- D. Submit minutes of meeting to District, Project Inspector and Architect, for Project record purposes.
- E. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.
 - 1. Refer to sequence requirements specified in Section 01 10 00 - Summary; and construction progress schedule requirements specified in Section 01 32 16 - Construction Progress Schedule.

1.06 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain property of East Whittier City School District, demolished materials shall become the Contractor's property and shall be removed, recycled, or disposed from Project site in an appropriate and legal manner.
 - 1. Arrange a meeting no less than ten (10) days prior to demolition with the District or Construction Manager and other designated representatives to review any salvagable items to determine if District wants to retain ownership, and discuss Contractor's Waste Management and Recycling Plan.

1.07 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
 - 2. Areas for temporary and permanent placement of removed materials.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
- D. Demolition phase:
 - 1. Proposed dust-control measures.
 - 2. Proposed noise-control measures.
 - 3. Schedule of demolition activities indicating the following:
 - a. Detailed sequence of demolition and removal work, including start and end dates for each activity.
 - b. Dates for shutoff, capping, and continuation of utility services.
 - 4. Contractor's Waste Management and Recycling Plan: See Section 01 74 19 - Construction Waste Management and Disposal.
 - a. This plan will not otherwise relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.
 - 5. Contractor's Reuse, Recycling, and Disposal Report: See Section 01 74 19 - Construction Waste Management and Disposal.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.
 - 1. Record drawings: Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.08 SUBMITTALS

- A. Demolition and Removal Procedures and Schedule: Submit for Project record only.
- B. Project Record Drawings: Submit in accordance with provisions specified in Section 01 78 00 - Closeout Submittals. Indicate verified locations of underground utilities and storm drainage system on project record drawings.

1.09 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of 5 years of documented experience.

1.10 SCHEDULING

- A. Schedule Work to precede new construction.
- B. Describe demolition removal procedures and schedule.
- C. Perform work between the hours of 8am and 5pm, subject to noise abatement regulations and District's approval for noise considerations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Conform to the relevant Article of the General Conditions, South Coast Air Quality Management District and other applicable regulatory procedures when discovering hazardous or contaminated materials.
- B. Field Measurements and Conditions:
 - 1. Survey existing conditions and correlate with requirements indicated to determine extent of demolition and recycling required.
 - 2. In addition to provisions of the Conditions of the Contract, verify dimensions and field conditions prior to construction. Verify condition of substrate and adjoining Work before proceeding with demolition Work. If conflict is found notify Construction Manager, Project Inspector and Architect.
- C. Comply with other requirements specified in Section 01 70 00.
- D. Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Obtain and pay for all permits required.
- E. Environmental Controls
 - 1. Comply with federal, state and local regulations pertaining to water, air, solid waste, recycling, chemical waste, sanitary waste, sediment and noise pollution.
 - 2. Confine demolition activities to areas defined by public roads, easements, and work area limits indicated on the drawings.
 - 3. Temporary Construction: Remove indications of temporary construction facilities, such as haul roads, work areas, structures, stockpiles or waste areas.
 - 4. Water Resources: Comply with applicable regulations concerning the direct or indirect discharge of pollutants to underground and natural surface waters.
 - a. Oily Substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water in such quantities as to affect normal use, aesthetics, or produce a measurable ecological impact on the area.

- 1) Store and service construction equipment at areas designated for collection of oil wastes.
- 5. Dust Control, Air Pollution, and Odor Control: Prevent creation of dust, air pollution and odors.
 - a. Use temporary enclosures and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.
 - b. Store volatile liquids, including fuels and solvents, in closed containers.
 - c. Properly maintain equipment to reduce gaseous pollutant emissions.
- 6. Noise Control: Perform demolition operations to minimize noise.
 - a. Repetitive, high level impact noise will be permitted only during the times indicated in Section 01 70 00 - Execution and Closeout Requirements. Repetitive impact noise on the property shall not exceed the following dB limitations:

Sound Level in dB	Time Duration of Impact Noise
70	More than 12 minutes in any hour
80	More than 3 minutes in any hour

- b. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary to comply with the requirements of this Contract.
 - c. At least once every five successive working days while work is being performed above 55 dB noise level, measure sound level for noise exposure due to the demolition.
 - 1) Measure sound levels on the 'A' weighing network of a General Purpose sound level meter at slow response.
 - 2) To minimize the effect of reflective sound waves at buildings, measurements may be taken three to six feet in front of any building face.
- F. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
- 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - a. Survey condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.
 - 1) Retain a licensed and qualified civil or structural engineer to provide analysis, including calculations, necessary to ensure the safe execution of the demolition work.
 - b. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.
 - c. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

5. Provide, erect, and maintain temporary barriers and security devices.
 - a. Provide, erect, and maintain temporary barriers, safety and security devices , for protection of streets, sidewalks, curbs, adjacent property and the public.
 - b. Protection: Protect existing construction and adjacent areas with temporary barriers and security devices in accordance with requirements specified in Section 01 50 00 - Temporary Facilities and Controls.
 - 1) Review location and type of construction of temporary barriers with District and/or the Construction Manager.
 - 2) Barriers shall control dust, debris and provide protection for persons occupying and using adjacent facilities.
 - 3) Maintain protected egress and access at all times, in accordance with requirements of authorities having jurisdiction and with permission of DSA (AHJ having jurisdiction).
6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
8. Do not close or obstruct roadways or sidewalks without permit.
9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- G. Do not begin removal until receipt of notification to proceed from District.
- H. Do not begin removal until built elements to be salvaged or relocated have been removed.
- I. Protect existing structures and other elements that are not to be removed.
 1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
 4. Protect existing landscaping materials, appurtenances, structures and items that are not to be demolished, or are on adjacent property.
 5. Mark location of utilities.
- J. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- K. Hazardous Materials: Comply with AHRI 560 and state and local regulations.
- L. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Section 01 60 00 - Product Requirements.
- M. Perform demolition in a manner that maximizes salvage and recycli
 1. Comply with requirements of Section 01 74 19 - Construction Disposal.
 2. Dismantle existing construction and separate materials.

3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- N. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

3.02 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
 2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 2. Remove items indicated on drawings.
 3. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 3. See Section 01 10 00 for other limitations on outages and required notifications.
 4. Verify that abandoned services serve only abandoned facilities before removal.
 5. Remove abandoned pipe, ducts, conduits, and equipment; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.

4. Patch as specified for patching new work.

3.03 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- C. Remove temporary work.
- D. Leave site in clean condition, ready for subsequent work.
- E. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 02 64 00
PVC PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish and install all Polyvinyl Chloride (PVC) plastic pipe, fittings, transitions, connections and appurtenant work, complete and in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02200 - Earthwork
- B. Section 02221 - Trenching, Backfilling and Compacting
- C. Section 02666 – Pressure Pipeline Water Testing

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards:

ASTM D 1784 and ASTM D 1785	Specifications for Polyvinyl Chloride (PVC) Plastic Pressure Pipe
ASTM D 3034	Specifications for Polyvinyl Chloride (PVC) Plastic Gravity Sewer Pipe
AWWA C 900 and AWWA C 905	Specifications for Polyvinyl Chloride (PVC) Plastic Water Pressure Pipe
ASTM D 2321	Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
NSF / ASNI 61	Drinking Water System Components – Health Effects

1.04 CONTRACTOR SUBMITTALS

- A. Contractor shall submit copies of the manufacturer's product specifications according to the requirements for Submittals.

PART 2 - PRODUCTS

2.01 PVC (POLYVINYL CHLORIDE) PRESSURE PIPE, 4 INCHES AND SMALLER SOLVENT-WELDED

- A. All PVC pressure pipe 4 inches and smaller shall be made from all new rigid unplasticized polyvinyl chloride and shall be Normal Impact Class 12454-B, Schedule 80, to conform to ASTM D 1785, unless otherwise shown. Elbows and tees shall be of the same material and schedule as the pipe. Unless otherwise shown, joint design shall be for solvent-welded construction.

2.02 AWWA C 900 AND AWWA C 905 WATER PIPELINE WITH BELL AND SPIGOT JOINTS

This Specification designates general requirements for unplasticized polyvinyl chloride (PVC) plastic class water pipe with integral bell and spigot joints for the conveyance of water. Pipe shall meet the requirements of AWWA C 900 or AWWA C 905 "Polyvinyl Chloride (PVC) Water Distribution".

All pipe shall be suitable for use as pressure conduit, provisions must be made for expansion and contraction at each joint with an elastomeric ring. The bell shall consist of an integral wall section with a factory installed, solid cross-section elastomeric ring which meets the requirements of ASTM F 477. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of AWWA C 900. Sizes and dimensions shall be as shown in this Specification. Joint design shall meet qualification requirements of ASTM F 3139. Each pipe shall be tested to four times the pressure class of the pipe for a maximum of 5 seconds. The integral bell shall be tested with the pipe. Standard laying lengths shall be 20 feet ($\pm 1''$) for all sizes.

The pipe stiffness using $F/\Delta Y$ for PVC class water pipe is contained in the table below:

CLASS	DR	F Δ y (PSI)
100	25	129
150	18	364
200	14	815

Pipe shall withstand, without failure at 73°F, an impact of a falling missile, TUP C, at the following levels (per ASTM D 2444):

Pipe Size (IN.)	Impact (FT./LBS.)
4	100
6	100
8	100
10	120
12	120

There shall be no visible evidence of shattering or splitting when the energy is imposed.

Randomly selected samples tested in accordance with ASTM D 1599 shall withstand, without failure, pressures listed below when applied in 60-70 seconds.

Class	Minimum Burst Pressure At 73°F (PSI)
100	535
150	755
200	985

Pipe for this Project shall conform with the specifications for AWWA C900, DR 18 PVC pipe material for diameter sizes 4-inches through 12 inches and AWWA C 905, DR 25 PVC pipe material for diameter sizes 14 inches through 36-inches unless otherwise indicated on the Plans.

2.03 PVC (POLYVINYL CHLORIDE) GRAVITY PIPE

- A. Pipe shall conform to the requirements of ASTM D 3034 for SDR 35 gravity pipe, unless otherwise indicated on the Plans.
- B. All pipe joints shall be of the bell and spigot type with electrometric seals and conform to the requirements of ASTM D 3212. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Gasket material shall conform to the requirements of ASTM F 477.
- C. All fittings shall be fabricated from pipe meeting the requirements of these standards. Fabricated miter joints shall be reinforced by fusion heat welding. All fittings shall be approved for use by the pipe manufacturer and shall be capable of accepting bell and spigot connections.
 - 1. There shall be no sign of flaking or disintegration when immersed in anhydrous acetone for 20 minutes as described in ASTM D 2152.
- D. All pipe shall be from quality PVC resin, compounded to provide physical and mechanical properties that equal or exceed cell class 12454 as defined in ASTM 1784.
- E. Minimum pipe stiffness at 5 percent deflection shall be 46 PSI for all sizes when tested in accordance with ASTM D 2412, External Loading Properties of Plastic Pipe by Parallel-Plate Loading”.

- F. Each pipe shall be identified with the name of manufacturer, nominal size, cell classification, ASTM designation F 1803, the pipe stiffness designation "PS-46" and manufacturer's date code.

2.04 NSF / ANSI STANDARD 61

Piping, fittings, and appurtenances in contact with potable water or water that will be treated to become potable shall be listed in NSF / ANSI Standard 61 as being suitable for contact with potable water.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPE

- A. All pipe, fittings, etc., shall be carefully handling and protected against damage, impact shocks and free fall. All pipe handling equipment shall be acceptable to the Engineer. Pipe shall not be placed directly on rough ground, but shall be supported in a manner which will protect the pipe against injury whenever stored at the Site. All pipe damaged prior to Substantial Completion shall be repaired or replaced by the Contractor.
- B. The Contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Damaged pipe shall be replaced with new undamaged sections of pipe.
- C. Before placement of the pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the Work. As pipe laying progresses, the Contractor shall keep the pipe interior free of all debris. The Contractor shall completely clean the interior of the pipe of all sand, dirt, rocks and any other debris following completion of pipe laying prior to testing, disinfecting and placing the completed pipeline in service.
- D. Pipe shall be laid directly on the imported bedding material. No blocking will be permitted and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Bell holes shall be formed at the ends of the pipe to prevent joint loading at the bells or couplings.
- E. Where necessary to raise or lower the pipe grade due to unforeseen obstructions or other causes, the Engineer may change the alignment and/or the grades. Such change shall be made by the deflection of joints or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer.

- F. No pipe shall be installed upon a foundation into which frost has penetrated or any time that there is a danger of the formation of ice or penetration of frost at the bottom of the excavation. No pipe shall be laid unless it can be established that the trench will be backfilled before the formation of ice and frost occurs.
- G. Immediately before jointing bell and spigot pipe, both the bell and spigot end of the pipe shall be thoroughly cleaned and lubricated with an approved vegetable-based lubricant. The spigot end of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper alignment. Tilting of the pipe to insert the spigot into the bell will not be permitted.
- H. Solvent-welded and heat-fused joints shall be carefully and thoroughly cleaned immediately before jointing the pipe. Particular care shall be taken in making solvent-welded joints to ensure a uniform, homogeneous and complete bond.
- I. Pipe installation shall conform with Technical Specification Section 02221 - Trenching, Backfilling and Compacting. If this installation of pipe section and Section 02221 conflict, the most stringent specification shall apply.

END OF SECTION 02640

**SECTION 02 72 60
MANHOLE AND PRECAST VAULT CONSTRUCTION**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated on the Plans and specified herein.
- B. This section covers the work necessary for the construction of manholes and precast vaults and catch basins. Manholes and vault details are as illustrated on the Plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02 73 00 - Sanitary Sewer and Stormwater Gravity Pipeline System Testing
- B. Section 03 30 00 - Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Comply with the applicable reference specifications as specified in the General Requirements.
- B. Comply with the current provisions of the following Codes and Standards.
 - 1. Commercial Standards:

ASTM A 48	Specification for Gray Iron Castings
ASTM C 150	Specification for Portland Cement
 - 2. Standard Specifications:

SSPWC Section 206-3	Gray Iron Casting
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1.04 CONTRACTOR SUBMITTALS

- A. Submittals shall be made in accordance with the General Requirements.
- B. Shop Drawings: The Contractor shall furnish complete shop drawings for all precast manhole sections, vaults, catch basins, cast iron frames and covers, and

appurtenances for review by the Engineer in accordance with Submittals of the General Requirements.

1.05 QUALITY ASSURANCE

- A. Inspection: After installation, the CONTRACTOR shall demonstrate that all manholes, vaults, and catch basins have been properly installed, level, with tight joints, at the correct elevations and orientations, and that the backfilling has been carried out in accordance with the Contract Documents.

PART 2 - PRODUCTS

2.01 GRANULAR BASE

- A. Granular base shall conform to Sections 02200 - Earthwork; and 02221 - Trenching, Backfilling and Compacting.

2.02 CONCRETE

- A. Ready-mixed, conforming to ASTM C 94, Alternate B. The concrete class for manhole bases and vault shall be 560-C-3250. The concrete class for manhole and precast vault walls and top shall be 560-C-3250. Maximum size of aggregate shall be 1.5 inches. Slump shall be between 2 and 5 inches. The concrete shall attain 5,000 PSI compressive strength after 28 days.

2.03 FORMS

- A. Exterior exposed surfaces shall be plywood. Others shall be matched boards, plywood, or other approved material. Provide forms on all vertical surfaces. Formwork shall comply with Section 03100 - Concrete Formwork. Trench walls, large rock, or native material will not be approved as form material.

2.04 REINFORCING STEEL

- A. Conform to ASTM A 615, Grade 40, deformed bars.

2.05 POURED-IN-PLACE MANHOLES

- A. Poured-in-place type manholes may be used provided all details of construction are accepted by the Engineer.

2.06 PRECAST MANHOLE SECTIONS

- A. Precast manhole sections shall be a minimum of 48 inches in diameter, conforming to any details illustrated on the Plans and to ASTM C 478. Minimum wall thickness shall be 5 inches for reinforced sections and 5 1/2 inches for unreinforced sections. Provide eccentric cones for all manholes. Cones shall have same wall thickness and reinforcement as manhole section. Top and bottom of all sections shall be parallel. Manholes shall be provided without steps. Joints shall be tongue-and-groove with rubber gaskets conforming to ASTM C 443. The Contractor's attention is directed to specification for mortar hereinafter.
- B. Prior to the delivery of precast manhole and vault sections to the Site, yard tests shall be conducted at the point of manufacture. The precast sections to be tested will be selected at random from the stockpiled material which is to be supplied for the job. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C 14.

2.07 PRECAST BASE SECTIONS AND BASES

- A. At the option of the Contractor, precast base sections or manhole and vault bases may be used provided all details of construction are approved by the Engineer. Base sections shall have the base slab integral with sidewalls. Base slab shall be constructed in accordance with the details illustrated on the Plans or Standard Details of the governing agency. Tie reinforcing steel to wallsteel.

2.08 MANHOLE AND VAULT EXTENSIONS

- A. Concrete grade rings for extensions shall be a maximum of 11 inches high and shall be approved by the Engineer before installation.
- B. In general, manhole and vault extensions will be used on all manholes in roads or streets or in other locations where a subsequent change in existing grade may be likely. Extensions will be limited to a maximum height of 11 inches unless otherwise approved by the Engineer. Finish grade for manhole covers shall conform to finished ground or street surface level, unless otherwise directed by the Engineer. Manhole covers and frames shall be placed 3 inches below the finished pavement surface prior to the installation of A.C. pavement. After A.C. pavement installation is successfully completed the manhole covers and frames shall be placed to the level of the finished pavement surface. A 1-foot wide, 1 foot deep P.C.C. collar shall be placed around the manhole frame and cover 3/8 inches below the level of the finished pavement surface.

2.09 MORTAR

- A. Standard premixed mortar conforming to ASTM C 387 or proportion 1 part Portland cement to 2 parts clean, well-graded sand which will pass a 1/8 inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: Hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the pipe when using the standard tongue-and-groove type joint. If the Keylock type joint is used, the consistency shall be such that excess mortar shall be forced out of the groove and support is not provided for the next precast manhole section to be placed. Mortar mixed for longer than 30 minutes shall not be used.

2.10 PREFORMED PLASTIC GASKETS

- A. Preformed plastic gaskets may be used in lieu of mortar type joints and shall be Kent-Seal No. 2 manufactured by Hamilton Kent Manufacturing Company, Kent, OH; Ram-Nek, manufactured by K.T. Snyder Company, Inc., Houston, TX; or approved equal, meeting all requirements of Federal Specification SS-S-00210.

2.11 PIPE STUBOUTS FOR FUTURE SEWER OR STORMWATER CONNECTIONS

- A. Pipe stubouts shall be the same type as approved for use in lateral, main, or trunk pipeline construction. Strength classifications shall be the same class as in adjacent trenches. Where there are two different classes of pipe at a manhole, the higher strength pipe will govern strength classification. Rubber gasketed watertight plugs shall be furnished with each stubout adequately braced against all hydrostatic or air test pressures.

2.12 PRECAST CONCRETE VAULT AND CATCH BASINS

- A. The precast concrete vault shall be precast with a 28 day, 5000 psi minimum compressive strength concrete and designed for AASHTO H-20 loading. Minimum dimensions shall be as illustrated on the Plans. Provide openings for pipes and grating as illustrated on the Plans.

2.13 STORMWATER VAULT STEPS

- A. Stormwater vault steps shall be made of minimum 3/4-inch galvanized steel bar conforming to ASTM A 36. Steps shall be 12 inch wide minimum, center-to-center of legs, and shall be drop pattern with a 2 inch drop. Bends shall be made around a 1 inch radius minimum, 2 inch radius maximum mandrel. There shall be 3 inch minimum embedment in precast concrete stormwater vault sections and 4-1/2 inch minimum projection from the face of concrete at point of embedment to the center of the step. There shall be a 2 inch hook on the embedment end. Galvanizing shall conform to ASTM A 123 and shall be accomplished after bending.
- B. The installed steps shall be located so as to provide a continuous ladder with steps equally spaced vertically in the assembled stormwater vault at 12 inches \pm 3/4 inch. The steps shall be capable of withstanding a force of 350 pounds, applied at any place on the step and in any direction which projects from the point of application through a diameter of the step cross-section at that point, with no permanent deformation resulting. Steps shall be cast in stormwater vault sections by the manufacturer.

2.14 MANHOLE FRAMES AND COVERS

- A. Cast iron or ductile iron of size and shape illustrated on the Plans. Covers shall have the word "SEWER" or "STORMWATER", as appropriate in 2 inch raised letters. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects, and shall conform to ASTM A 48, Class 30B. Plane or grind bearing surfaces to ensure flat, true surfaces. Covers shall be true and seat within ring at all points. Frames shall have a minimum opening of 24 inches for a 4 foot diameter manhole and 30 inches for 5 foot diameter manholes.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL

- A. Conform to applicable portions of Section 02200 - Earthwork, and Section 02221 - Trenching, Backfilling and Compacting. Backfill around manholes and vaults.

3.02 GRANULAR BASE

- A. Remove water from the excavation. Unless specified in the Plans, place a minimum of 18 inches of Class 2 Base or 1 inch rock and thoroughly compact with a mechanical or power vibrating tamper.

3.03 CONCRETE BASE

- A. Construct concrete base in conformance with the details illustrated on the Plans. Vibrate to densify the concrete and screed so that the first precast manhole section to be placed has a level, uniform bearing for the full circumference.
- B. Deposit sufficient mortar on base to assure watertight seal between base and manhole wall or place the first precast section of manhole in concrete base before concrete has set (preferred). First section shall be properly located and plumbed at 90-degree angles.
- C. If material in bottom of trench is unsuitable for the manhole, excavate below the flow line as directed by Engineer, and backfill to required grade with 1 inch rock. Place a filter fabric material in the excavation above the level of the concrete base prior to installing the 1 inch rock.

3.04 PLACING PRECAST MANHOLE SECTIONS

- A. Clean ends of sections of foreign materials. Thoroughly wet joint with water prior to placing mortar. Place mortar on groove of lower section. Set next section in place. Fill joint completely with mortar of the proper consistency. Trowel interior and exterior surfaces smooth on standard tongue-and-groove joints. Wipe or otherwise clean the excess mortar from the inside of the Keylock joint.
- B. When a Keylock joint is used, it is the intent that the void between the tongue-and-groove be completely filled with mortar, and that the interior and exterior end faces of the section to be placed seat fully on the previously placed section.
- C. Prevent mortar from drying out and cure by applying an approved curing compound or comparable approved method. Chip out and replace all cracked or defective mortar. Completed manholes shall be rigid and watertight.

3.05 PREFORMED PLASTIC GASKETS

- A. Carefully inspect precast manhole sections to be joined. Sections with chips or cracks in the tongue shall not be used. Preformed plastic gaskets shall be installed in strict conformance with the manufacturer's recommendations. Only pipe primer furnished by the gasket manufacturer will be approved.

3.06 MANHOLE INVERT

- A. Construct manhole inverts in conformance with details illustrated on the Plans, and with smooth transitions to ensure an unobstructed flow through the manhole. Remove all sharp edges or rough sections which tend to obstruct flow. Where a full section of pipe is laid through a manhole, break out the top section as indicated and cover exposed edge of pipe completely with mortar. Trowel all mortar surfaces smooth.

3.07 FLEXIBLE JOINTS

- A. Provide joints in all pipe not more than 1.5 feet from manhole walls. Lay pipes entering manholes on firmly compacted granular sand backfill or rock to undisturbed native earth. Granular sand backfill or rock shall be as specified hereinbefore.
- B. Where the last joint of the installed pipeline up to the manhole is more than 1.5 feet from the manhole base, a 6 inch concrete encasement shall be constructed around the entire pipe from the manhole base to within 1.5 feet of the pipe joint. The pipe encasement shall be constructed monolithically with the manhole base. Pipes installed out of the manhole shall be shortened to ensure the first joint is no more than 1.5 feet from the manhole base.

3.08 PIPE STUBOUTS FOR FUTURE SEWER AND STORMWATER CONNECTIONS

- A. Install stubouts in manholes for future sewer and stormwater connections as illustrated on the Plans or as required by the Engineer. Maximum length shall be 1.5 feet outside the manhole wall. Grout pipes in precast walls or manhole base to provide watertight seal around pipes. Construct invert channels in accordance with details shown on the Plans. Provide compacted granular sand or 1 inch rock as specified hereinbefore to undisturbed earth under all stubouts.
- B. Install semi-permanent plugs at the end of stubouts with gasket joints similar to sewer and stormwater pipe being used. Plugs shall be capable of withstanding all internal or external pressures without leakage. All plugs to be braced to prevent blowoffs.

3.09 PERMANENT PLUGS

- A. Clean interior contact surfaces of all pipes to be cut off or abandoned as illustrated on the Plans. Construct concrete plugs at the end of all pipes 18 inches or less in diameter. Minimum length of concrete plugs shall be 8 inches. For pipe 21 inches and larger, the plugs may be constructed of common brick or concrete block. Plaster the exposed face of block or brick plugs with mortar. All plugs shall be watertight and capable of withstanding all internal and external pressures without leakage.

3.10 MANHOLE EXTENSIONS

- A. Install extensions in conformance with the details illustrated on the Plans, and to a maximum height of 12 inches unless a larger height is approved by the Engineer. Lay grade rings in mortar with sides plumb and tops level. Seal joints with mortar as specified for manhole sections. Extensions shall be watertight.

3.11 MANHOLE FRAMES AND COVERS

- A. Install frames and covers on top of manholes to positively prevent all infiltration of surface or groundwater into manholes. Frames shall be set in a bed of mortar with the mortar carried over the flange of the ring as shown in the Manhole Details on the Plans. Set frames so that tops of covers are flush with surface of adjoining pavement or ground surface, unless otherwise illustrated or directed by the Engineer except within A.C. pavement surfaces. A 1 foot wide, 1 foot deep P.C.C. collar shall be placed around all manhole rings and covers. The concrete ring and manhole frames and covers in A.C. pavement areas shall be placed 3/8 inch lower than the finished A.C. pavement surface. The manhole frame and cover shall be lowered 3 inches below the finished A.C. pavement surface prior to the installation of the A.C. pavement.

3.12 MANHOLES OVER EXISTING SEWERS AND STORMWATER

- A. Construct manholes over existing operating sewer and stormwater lines at locations illustrated on the Plans. Perform necessary excavation work as required to break into the existing sewer and stormwater pipeline and construct the manhole. Comply with previously-noted specifications.
- B. Maintain flow through existing sewer and stormwater pipelines at all times, and protect new concrete and mortar work for a period of 7 days after concrete has been placed. Advise Engineer of plans for diverting wastewater flow and obtain Engineer's approval before starting. Engineer's approval will not relieve Contractor of responsibility for maintaining adequate capacity for flow at all times and adequately protecting new and existing work.

- C. Construct the new base under the existing sewer and stormwater and the precast sections as specified herein.
- D. Break out the existing pipe within the new manhole, cover the edges with mortar, and trowel smooth.

3.13 SPECIAL MANHOLES

- A. Construct special manholes in conformance with applicable parts of these Specifications and as illustrated on the Plans.

3.14 PRECAST CONCRETE VAULT

- A. Install precast concrete vaults at the locations illustrated on the Plans. Provide necessary excavation and backfill as specified herein and as specified by Section 02200 - Earthwork and Section 02221 - Trenching, Backfilling and Compacting.

3.15 HYDROSTATIC TESTING

- A. Hydrostatic testing of manholes and vaults shall be completed in conformance with Section 02730 - Sanitary Sewer and Stormwater Gravity Pipeline System Testing.

3.16 MANHOLES - INTERIOR COATING SYSTEM

The interior of all manholes, including the manhole base surfaces and grade rings shall be coated according to the provisions of this specification:

- A. Install a low temperature 100 percent solids acrylated epoxy primer system designed to provide positive cure down to 20°F and extremely rapid room temperature cure. The solids acrylated epoxy is to be applied as a primer material to the interior of the manhole surfaces. Apply the polyurethane system over the primer system within the surface interior of the P.C.C. manhole per the manufacturer's recommendations. The interior surface of the P.C.C. manhole shall be primed with a 1- to 3 mil thickness of 100 percent solids acrylated epoxy primer system to the abrasive grit blasted ring and to all concrete surfaces, including into the invert down to the low flow water line. Allow the primer to tack up (sticky to the touch). A 125 mil thickness polyurethane coating system shall be applied to the primer and all interior surfaces of the P.C.C. manhole after the primer has attained the required consistency.

Prior to the application of the 100 percent solids acrylated epoxy primer and polyurethane protective lining, the manhole shall be thoroughly cleaned by high

water pressure blast at pressures of 34.5 MPA (5,000 PSI), minimum to 68.9 MPA (10,000 PSI) maximum. Debris from cleaning shall not be allowed to enter the pipeline system. The Contractor shall provide the necessary debris containment devices while maintaining pipeline flow. The Contractor shall remove and dispose of all debris collected from the cleaning operation per 500 1.4 of the *Greenbook* specifications.

The cured polyurethane lining shall be spark tested for pinholes with a spark tester set at 15,000 volts minimum. All pinholes shall be repaired as specified in the *Greenbook* Specification 500 2.4.9.

All pinholes in the protective lining shall be marked off on surface areas containing pinholes to a point 6 inches beyond all pinholes, primed with epoxy, and re-coated with polyurethane to a minimum additional thickness of 30 mils. Blisters, uncured lining and surface imperfections shall be completely removed and the areas re-coated with epoxy primer and polyurethane lining to a point 6 inches beyond the repair areas at a minimum thickness of 100 mils.

The epoxy primer and polyurethane lining shall meet or exceed the requirements specified in *Greenbook* Specification 303-2 and *Greenbook* Table 500 2.4.10(A) as follows:

TABLE 500-2.4.10(A)

	POLYURETHANE	EPOXY
Tensile Strength ASTM D 638, Type IV, MPA (PSI)	13.8 (2,000)	41.4 (6,000)
Elongation at Break, % ASTM D 638, Type IV	50	5
Wear Resistance, MG. Wt. Loss Taber Abrasion, S-17	60	100
Hardness, Shore D, Durometer ASTM D 2240	55	75
Tear Resistance, KG/MM (PPI) ASTM D 903	2.7 (150)	N/A
Peel Strength, Concrete, G/MM (PLI) ASTM D 903	125 (7) 1	125 (7) 1
Adhesive Strength, KPA (PSI) ASTM C 190 (Modified Briquet)	2760 (400) 1	2760 (400) 1

Test results shall be verified on a per-job basis or as required by the Engineer.

The coating system shall be a Zebtron Number 386 or an approved equal. The coating system shall be applied per the manufacturer's recommendations.

END OF SECTION 02 72 06

SECTION 02 73 00
SANITARY SEWER AND STORMWATER GRAVITY
PIPELINE SYSTEM TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated on the Plans and specified herein.
- B. This Section covers the performance of all pipeline flushing and testing, complete, for stormwater and sanitary sewer system piping as specified herein and in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02726 - Manhole and Precast Vault Construction.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Comply with the applicable reference specifications as specified in the General Requirements.

1.04 CONTRACTOR SUBMITTALS

- A. Submittals shall be made in accordance with the General Requirements.
- B. The Contractor shall submit in writing all proposed plans for testing, and for water conveyance, control and disposal. The Contractor shall also submit written notice four (4) days in advance of the proposed testing schedule for review and concurrence of the Engineer.

1.05 QUALITY ASSURANCE (NOT USED)

PART 2 - PRODUCTS

2.01 GENERAL

- A. Temporary valves, plugs, bulkheads, and other air pressure testing and water control equipment and materials shall be provided by the Contractor subject to the Engineer's review. No materials shall be used which will be injurious to pipeline structure and future function. Air test gauges shall be laboratory-

calibrated annually test gauges and shall be recalibrated by a certified laboratory at the Contractor's expense prior to the leakage test, only if required by the Engineer.

PART 3 - EXECUTION

3.01 GENERAL

- A. Unless otherwise specified, water for testing will be furnished by the Owner; however, the Contractor shall make all necessary provisions for conveying the water from the Owner-designated source to the points of use. The Contractor shall provide all double backflow reduced pressure principal check valves approved by the State of California Health Department, hand-operated valves, water meters and all related piping and fittings to be attached to the water source (in most cases a fire hydrant) as required by the Owner.
- B. Release of water from pipelines, after testing has been completed, shall be performed as reviewed by the Engineer. The Contractor shall be responsible for the removal and deposition of the water. The Contractor shall be responsible for identifying the point of deposition of the water. The Contractor shall bear all expenses relative to the removal of the water.
- C. All testing operations shall be performed in the presence of the Engineer.

3.02 TESTING OF PIPELINE

- A. General: All gravity sewer pipes and service laterals and stormwater pipes shall be tested for exfiltration and/or infiltration and deflection, as specified. All manholes shall be tested for leakage, as specified. Manholes shall be tested prior to backfill placement, whereas all pipe shall be backfilled prior to testing. All leakage tests of sanitary sewer and stormwater systems shall be in conformance with SSPWC Section 306-1.4.1. For pressure sewers (force main tests), the force mains shall be tested in accordance with the hydrostatic testing requirements of a potable water pipeline per Section 02666 of this document.
- B. Water Exfiltration Test shall be in conformance with SSPWC Section 306-1.4.2.
- C. Water Infiltration Test shall be in conformance with SSPWC Section 306-1.4.3. Unless otherwise specified, infiltration will be measured by the Contractor using measuring devices approved by the Engineer.

- D. Air Pressure Test shall be accomplished by means of “Low Pressure Air Testing”. Tests may be conducted by the Contractor or an independent testing firm. However, acceptance tests shall be made only in the presence of the Engineer.

Test Procedure:

1. Before testing, the pipe shall be thoroughly cleaned.
2. The Contractor shall seal off the section of pipe to be tested at each manhole connection. Test plugs must be securely braced within the manholes.
3. A minimum of two (2) connection hoses to link the air inlet test plug with an above ground test monitoring panel must be provided.
 - a) One hose is to induce air through the test plug and into the test chamber.
 - b) The second hose is for the purpose of monitoring the test pressure from within the enclosed pipe.
4. Under no circumstances are workers to be allowed in the connecting manholes while a pressure test is being conducted.
5. Add air slowly into the test section. After an internal pressure of 4.0 PSI is obtained, allow internal air temperature to stabilize.
6. After stabilization period, adjust the internal air pressure to 3.5 PSI, disconnect the air supply and begin timing the test.
7. Refer to “Air Test Table”, below, to determine the length of time (minutes) the pipeline section being tested must sustain air pressure while no losing in excess of 1 PSI as monitored by the test gauge. If the section of pipeline to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.
8. Sections so determined to have lost 1 PSI or less during the test period will have passed the leakage test. Those sections losing in excess of 1 PSI during the test period will have failed the leakage test.
9. Appropriate repairs must then be completed and the line re-tested for acceptance.

AIR TEST TABLE			
Minimum Test Time for Various Pipe Sizes*			
Nominal Pipe Size, In.	T (Time), Min/100 Ft.	Nominal Pipe Size, In.	T (Time), Min/100 Ft.
3	0.2	21	3.0
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	39	6.6
18	2.4	42	7.3

*The time has been established using the formulas contained in ASTM C 828, Appendix

- E. At the Contractor's option, joints may be air tested individually, joint by joint, with the use of specialized equipment. The Contractor shall submit its joint testing procedure for the Engineer's review and approval prior to testing. Prior to each test, the pipe at the joint shall be wetted with water. The maximum test pressure shall be 3.0 PSI. The minimum allowable pressure drop shall be 1.0 PSI over a 30 second test period.
- F. Water Pressure Test shall be in conformance with SSPWC Section 306-1.4.5.
- G. Deflection Test: All flexible and semi-rigid main line pipe shall be tested in accordance with SSPWC Sections 306-1.2.12 and 306-1.2.13 for deflection, joint displacement, or any other obstruction by passing a rigid mandrel through the pipe by hand, not less than 30 days after completion of the trench backfill, but prior to permanent resurfacing. The mandrel shall be a full circle, solid cylinder, or a rigid, non-adjustable, odd-numbered leg (9 leg minimum) steel cylinder, accepted by the Engineer as to design and manufacture. The circular cross section of the mandrel shall have a diameter of at least 95 percent of the specified average inside diameter of the pipe and the minimum length of the circular portion of the mandrel shall be equal to the nominal diameter of the pipe. Obstructions encountered by the mandrel shall be corrected by the Contractor.

3.03 TESTING OF MANHOLES

- A. All sewer and stormwater manholes shall be hydrostatically tested for leakage after installation, but prior to being backfilled. Prior to hydrostatic testing, all manholes shall be visually inspected for leaks. All leaks or cracks shall be

repaired by the Contractor, prior to hydrostatic testing, to the satisfaction of the Engineer. All pipes entering the manhole shall be sealed at a point outside the manhole walls so as to include testing of the pipe/manhole joints. The manhole shall be filled with water to a level 2 inches below the top of the frame. Safety lines shall be secured to all plugs utilized. After a period of at least one (1) hour to allow the water level to stabilize and soak into the concrete interior surfaces, the manhole shall be refilled and the water level shall be checked and documented. The water level shall be checked after a period of 4 hours. Leakage in each manhole shall not exceed 0.05 gallon per hour per foot of head above the invert. The Contractor shall be required to make all necessary repairs and retest the manhole in the event the water test fails. The exterior of the manhole shall be inspected during this period for visible evidence of leakage. Visible moisture, sweating, or beads of water on the exterior of the manhole shall not be considered leakage, but any water running across the surface will be considered leakage and shall be repaired to the satisfaction of the Engineer regardless of the volume of water lost.

END OF SECTION 02 73 00

SECTION 03 01 00
MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cleaning of existing concrete surfaces.
- B. Repair of exposed structural, shrinkage, and settlement cracks.
- C. Resurfacing of concrete surfaces having spalled areas and other damage.
- D. Repair of deteriorated concrete.
- E. Repair of internal concrete reinforcement.
- F. Scope of Work: As indicated on the drawings and as required as work progresses for hidden conditions after consultation with the Architect.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 REFERENCE STANDARDS

- A. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2016.
- B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).
 - 1. Use 2013 as indicated in the 2016 CBC Referenced Standards.
- C. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
 - 1. Use 2012 as indicated in the 2016 CBC Referenced Standards
- D. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- E. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2015.
- F. ASTM C928/C928M - Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Material for Concrete Repairs; 2013.
- G. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.
- H. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
 - 1. Use 2011 as indicated in the 2016 CBC Referenced Standards.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Scheduling: Perform blast cleaning only between the hours of 7 am to 10 pm.

1.05 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.

- B. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.
- C. Project Record Documents: Accurately record actual locations of structural reinforcement repairs and type of repair.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Cleaner Qualifications: Company specializing in, and with minimum of 3 years of experience in, the type of cleaning specified.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum of 3 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturers' instructions for storage, shelf life limitations, and handling of products.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

- A. Degreaser:
 - 1. Manufacturers:
 - a. Euclid Chemical Company; Euco Clean and Strip: www.euclidchemical.com/#sle.
 - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; CITREX: www.lmcc.com/#sle.
 - c. SpecChem, LLC; Orange Peel-Citrus Cleaner: www.specchemllc.com/#sle.
 - d. W.R. Meadows, Inc: www.wrmeadows.com.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Detergent: Non-ionic detergent.

2.02 CEMENTITIOUS PATCHING AND REPAIR MATERIALS

- A. Manufacturers:
 - 1. Adhesives Technology Corporation: www.atcepoxy.com/#sle.
 - 2. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 - 3. Dayton Superior Corporation; _____: www.daytonsuperior.com/#sle.
 - 4. The QUIKRETE Companies: www.quikrete.com/#sle.
 - 5. SpecChem, LLC: www.specchemllc.com/#sle.
 - 6. W. R. Meadows, Inc: www.wrmeadows.com/#sle.
 - 7. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Bonding Slurry: Water-based latex admixture complying with ASTM C1059/C1059M, combined with Portland cement and sand in accordance with admixture manufacturer's instructions.
1. Admixture Manufacturers:
 - a. Dayton Superior Corporation; _____: www.daytonsuperior.com/#sle.
 - b. The QUIKRETE Companies; QUIKRETE® Concrete Bonding Adhesive: www.quikrete.com/#sle.
 - c. SpecChem, LLC; Strong Bond - Acrylic Bonder: www.specchemllc.com/#sle.
 - d. W. R. Meadows, Inc; Acry-lok: www.wrmeadows.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cementitious Resurfacing Mortar: One- or two-component, factory-mixed, polymer-modified cementitious mortar designed for continuous thin-coat application.
1. Mixed with water or latex type bonding agent in proportions as recommended by manufacturer.
 2. Recommended Thickness: Feather edge to 1/8 inch.
 3. Color: Gray.
 4. Manufacturers:
 - a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com/#sle.
 - b. Dayton Superior Corporation; _____: www.daytonsuperior.com/#sle.
 - c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Duracrete: www.lmcc.com/#sle.
 - d. The QUIKRETE Companies; QUIKRETE® Concrete Resurfacer: www.quikrete.com/#sle.
 - e. SpecChem, LLC; Duo Patch: www.specchemllc.com/#sle.
 - f. SpecChem, LLC; Final Finish: www.specchemllc.com/#sle.
 - g. W. R. Meadows, Inc; Parge-All AF: www.wrmeadows.com/#sle.
 - h. W. R. Meadows, Inc; Meadow-Patch T2: www.wrmeadows.com/#sle.
 - i. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Cementitious Repair Mortar, Trowel Grade: One- or two-component, factory-mixed, polymer-modified cementitious mortar.
1. Mixed with water or latex type bonding agent in proportions as recommended by manufacturer.
 2. Integral corrosion inhibitor.
 3. Products:
 - a. Adhesives Technology Corporation; HARD-ROK JET PATCH: www.atcepoxy.com/#sle.
 - b. Five Star Products, Inc; Five Star Structural Concrete V/O: www.fivestarprouducts.com/#sle.
 - c. The QUIKRETE Companies; QUIKRETE® FastSet Repair Mortar: www.quikrete.com/#sle.
 - d. SpecChem, LLC; RepCon V/O: www.specchemllc.com/#sle.
 - e. SpecChem, LLC; Duo Patch: www.specchemllc.com/#sle.

- f. W. R. Meadows, Inc; Meadow-Crete GPS: www.wrmeadows.com/#sle.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Cementitious Repair Mortar, Form and Pour/Pump Grade: Flowable, one- or two-component, factory-mixed, polymer-modified cementitious mortar; in-place material resistant to freeze/thaw conditions.
 - 1. Mixed with water in proportions as recommended by manufacturer.
 - 2. Integral corrosion inhibitor.
 - 3. Manufacturers:
 - a. ARDEX Engineered Cements; ARDEX FDM: www.ardexamericas.com/#sle.
 - b. Dayton Superior Corporation; _____: www.daytonsuperior.com/#sle.
 - c. Five Star Products, Inc; Five Star Structural Concrete: www.fivestarprouducts.com/#sle.
 - d. SpecChem, LLC; Duo Patch; www.specchemllc.com/#sle.
 - e. SpecChem, LLC; RepCon H-350; www.specchemllc.com/#sle.
 - f. W. R. Meadows, Inc; Meadow-Crete FNP: www.wrmeadows.com/#sle.
 - g. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Cementitious Pavement Repair Mortar: Fast hardening, flowable; composed of cement, sand, and additives; capable of setting in cold weather conditions without the aid of chloride- or gypsum-based accelerators; in-place material resistant to freeze/thaw conditions.
 - 1. Dry Material: Complies with ASTM C928/C928M.
 - 2. Manufacturers:
 - a. Dayton Superior Corporation; _____: www.daytonsuperior.com/#sle.
 - b. Prospec; Premium Patch 100: www.prospec.com.
 - c. Prospec; Premium Patch 200: www.prospec.com.
 - d. SpecChem, LLC; RepCon 928: www.specchemllc.com/#sle.
 - e. SpecChem, LLC; RepCon 928 FS: www.specchemllc.com/#sle.
 - f. W. R. Meadows, Inc; Futura-15: www.wrmeadows.com/#sle.
 - g. W. R. Meadows, Inc; Futura-45 or Futura-45 Extended: www.wrmeadows.com/#sle.
 - h. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 EPOXY PATCHING AND REPAIR MATERIALS

- A. Manufacturers:
 - 1. Adhesives Technology Corporation: www.atcepoxy.com/#sle.
 - 2. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
 - 3. SpecChem, LLC: www.specchemllc.com/#sle.
 - 4. W. R. Meadows, Inc: www.wrmeadows.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Epoxy Repair Mortar: Epoxy resin mixed with aggregate and other materials in accordance with manufacturer's instructions for purpose intended; comply with pot life and workability limits.

1. Manufacturers:
 - a. Adhesives Technology Corporation; Crackbond LR-321: www.atcepoxy.com/#sle.
 - b. Dayton Superior Corporation; _____: www.daytonsuperior.com/#sle.
 - c. The QUIKRETE Companies; QUIKRETE® FastSet Anchoring Epoxy: www.quikrete.com/#sle.
 - d. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000 or SpecPoxy 3000 FS: www.specchemllc.com/#sle.
 - e. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000, Rezi-Weld LV, or Rezi-Weld LV State: www.wrmeadows.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Epoxy Injection Adhesive:
 1. Manufacturers:
 - a. Adhesives Technology Corporation; Crackbond LR-321: www.atcepoxy.com/#sle.
 - b. Dayton Superior Corporation; _____: www.daytonsuperior.com/#sle.
 - c. SpecChem, LLC; SpecPoxy 1000; www.specchemllc.com/#sle.
 - d. W. R. Meadows, Inc; Rezi-Weld LV, Rezi-Weld LV State, Rezi-Weld (IP), or Rezi-Weld Gel Paste: www.wrmeadows.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Epoxy Bonding Adhesive: Non-sag, two-part, 100 percent solids; recommended by manufacturer for purpose and conditions under which used.
 1. Non-Load-Bearing Applications: ASTM C881/C881M Type I, II, III, IV, or V, whichever is appropriate to application.
 2. Load-Bearing Applications: ASTM C881/C881M Type IV or V, whichever is appropriate to application.
 3. Other Applications: ASTM C881/C881M Type as appropriate to application.
 4. Manufacturers:
 - a. Adhesives Technology Corporation; Crackbond LR-321: www.atcepoxy.com/#sle.
 - b. Adhesives Technology Corporation; Crackbond SLV-302: www.atcepoxy.com/#sle.
 - c. Adhesives Technology Corporation; Ultrabond 2100: www.atcepoxy.com/#sle.
 - d. SpecChem, LLC; SpecPoxy 2000: www.specchemllc.com/#sle.
 - e. SpecChem, LLC; SpecPoxy 3000: www.specchemllc.com/#sle.
 - f. SpecChem, LLC; SpecPoxy 3000 FS: www.specchemllc.com/#sle.
 - g. W. R. Meadows, Inc; Rezi-Weld Gel Paste: www.wrmeadows.com/#sle.
 - h. W. R. Meadows, Inc; Rezi-Weld Gel Paste State: www.wrmeadows.com/#sle.
 - i. W. R. Meadows, Inc; Rezi-Weld 1000: www.wrmeadows.com/#sle.
 - j. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

- A. Anchoring Adhesive: Self-leveling or non-sag as applicable.
 1. Self-Leveling Polyester-Based Products:
 - a. W. R. Meadows, Inc; Poly-Grip: www.wrmeadows.com/#sle.

- b. Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Self-Leveling Epoxy Products:
 - a. SpecChem, LLC; SpecPoxy 2000; www.specchemllc.com/#sle.
 - b. W. R. Meadows, Inc; Rezi-Weld 1000, Rezi-Weld (IP), or Rezi-Weld 3/2: www.wrmeadows.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- 3. Non-Sag Epoxy Products:
 - a. Dayton Superior Corporation; _____: www.daytonsuperior.com/#sle.
 - b. SpecChem, LLC; SpecPoxy 3000 or SpecPoxy 3000 FS: www.specchemllc.com/#sle.
 - c. W. R. Meadows, Inc; Rezi-Weld Gel Paste or Rezi-Weld Gel Paste State: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Portland Cement: ASTM C150/C150M, Type I, grey.
- C. Sand: ASTM C33/C33M or ASTM C404; uniformly graded, clean.
- D. Water: Clean and potable.
- E. Reinforcing Steel: ASTM A615/A615M Grade 60 (60,000 psi) billet-steel deformed bars, unfinished.
- F. Reinforcing Steel: Deformed bars, ASTM A996/A996M Grade 60 (420), Type A.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means acceptance of substrate.

3.02 CLEANING EXISTING CONCRETE

- A. Provide enclosures, barricades, and other temporary construction as required to protect adjacent work from damage.
- B. Clean concrete surfaces of dirt or other contamination using the gentlest method that is effective.
 - 1. Try the gentlest method first, then, if not clean enough, use a less gentle method taking care to watch for impending damage.
 - 2. Clean out cracks and voids using same methods.
- C. The following are acceptable cleaning methods, in order from gentlest to less gentle:
 - 1. Water washing using low-pressure, maximum of 100 psi, and, if necessary, brushes with natural or synthetic bristles.
 - 2. Increasing the water washing pressure to maximum of 400 psi.
 - 3. Adding detergent to washing water; with final water rinse to remove residual detergent.
 - 4. Steam-generated low-pressure hot-water washing.
- D. Do not use any of the following cleaning methods, unless otherwise indicated:

1. Brushes with wire bristles, grinding with abrasives, solvents, hydrochloric or muriatic acid, sodium hydroxide, caustic soda, or lye.
2. Soap or detergent that is not non-ionic.
3. Alkaline cleaning agents.
4. Acidic cleaning agents.
5. Abrasive blasting.

3.03 CONCRETE STRUCTURAL MEMBER REPAIR

- A. See the drawings for known specific areas to be repaired (if any).
- B. Remove broken and soft concrete at least 1/4 inch deep.
- C. Mechanically cut away damaged portions of reinforcement.
- D. Remove corrosion from steel and clean mechanically.
- E. Blast clean remaining exposed reinforcement surfaces.
- F. Repair by welding new bar reinforcement to existing reinforcement using sleeve splices.
 1. Perform welding work in accordance with AWS D1.4/D1.4M.
 2. Make welded sleeve splices to achieve strength to exceed strength of new reinforcement.
- G. Cover exposed steel reinforcement with epoxy mortar.
- H. Work epoxy mortar into broken surface and build up patch to match original.
- I. Feather edges of repairs flush to sound surface and trowel surface to match surrounding area.

3.04 CRACK REPAIR USING EPOXY ADHESIVE INJECTION

- A. Repair exposed cracks.
- B. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than the depth of the crack to be filled or port size diameter no greater than the thickness of the crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.
- C. Inject adhesive into ports under pressure using equipment appropriate for particular application.
- D. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.
- E. Remove temporary seal and excess adhesive.
- F. Clean surfaces adjacent to repair and blend finish.

3.05 CONCRETE SURFACE REPAIR USING CEMENTITIOUS MATERIALS

- A. Clean concrete surfaces, cracks, and joints of dirt, laitance, corrosion, and other contamination using method(s) specified above and allow to dry.
- B. Apply coating of bonding agent to entire concrete surface to be repaired.
- C. Fill voids with cementitious mortar flush with surface.

- D. Apply repair mortar by steel trowel to a minimum thickness of 1/4 inch over entire surface, terminating at a vertical change in plane on all sides.
- E. Trowel finish to match adjacent concrete surfaces.

3.06 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 40 00, will perform field inspection and testing.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall provide concrete formwork, bracing, shoring, supports, and false work, in accordance with the Contract Documents.
- B. Work included in this Section: Principal items are:
 - 1. Furnishing, erection, and removal of forms.
 - 2. Shoring and bracing of formwork.
 - 3. Setting of embedded items and pipe sleeves for mechanical and electrical work under direction of respective trade.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of the Work.
 - 1. Section 03 20 00 - Reinforcement Steel
 - 2. Section 03 29 00 - Joints in Concrete Structures
 - 3. Section 03 30 00 - Cast-in-Place Concrete
 - 4. Section 03 31 50 - Grout

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional Amendments.
- B. The current edition of the Uniform Building Code (UBC) of International Conference of Building Officials (ICBO).
- C. Except as otherwise indicated, the current editions of the following apply to the Work of this Section:

1. PS 1 U.S. Product Standard for Concrete Forms, Class 1
2. PS 20 American Softwood Lumber Standard
3. ACI 117 Standard Tolerances for Concrete Construction and Materials
4. ACI 347 Recommended Practice for Concrete Formwork

1.04 CONTRACTOR SUBMITTALS

- A. The Contractor shall, in accordance with the requirements in the Specification Section for Contractor Submittals, submit detailed drawings of the false work proposed to be used. Such drawings shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grade of materials to be used in the false work, means of protecting existing construction which supports false work, and typical soil conditions.
- B. The Contractor shall, in accordance with the requirements in the Specification Section 01300 – Contractor Submittals, submit the following:
 1. Form ties and all related accessories, including taper tie plugs, if taper ties are used.
 2. Form gaskets.
- C. The Contractor shall provide concrete construction joints and expansion joints of the types and locations indicated on the Plans. The Contractor shall submit shop drawings showing the proposed location and type of required construction for any joints not shown on the Plans, and the sequence of forming and concrete placing operations.
- D. Forms and false work to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 50 PSF (minimum). The minimum design load for combined dead and live loads shall be 100 PSF.
- E. The Contractor shall design formwork prior to fabrication, placing the order, or use on the jobs.
- F. The Contractor shall design joints in forms to remain mortar-tight and withstand placing pressures without bulging outward or creating surface patterns.

- G. Calculations shall be signed and sealed by a Professional Civil or Structural Engineer registered in the State of California for both the forming system and the stresses induced on the form system.
- H. Suitable and effective means shall be provided for holding adjacent edges and end panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets or similar surface defects in the finished concrete. The forms shall be tight so as to prevent the loss of water, cement, and fines during placing and vibrating of the concrete.

1.05 QUALITY ASSURANCE

- A. The Contractor shall comply with the requirements of California Division of Occupational Health and Safety Construction Safety Orders Section 1717 and OSHA Part 1926, Section 1926.701 that apply to the Work of this Section. The Contractor shall prepare and maintain at least one copy of the required Plans at the site. Design of the structures shown on the Plans does not include any allowance or consideration for imposed construction loads. The Contractor shall provide forms, shoring and false work adequate for imposed live and dead loads, including equipment, height of concrete drop, concrete and foundation pressures, stresses, lateral stability, and other safety factors during construction.
- B. Tolerances: The Contractor shall employ formwork complying with ACI 347 Guide to Formwork for Concrete, except as exceeded by the requirements of regulatory agencies, or as otherwise indicated or specified. The Contractor shall design and construct formwork to produce finished concrete conforming to tolerances given in ACI 117.

PART 2 - PRODUCTS

2.01 GENERAL

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

Walls:	Steel or plywood panel
Columns:	Steel, plywood or fiberglass
Roof and Floor:	Plywood
All Other Work:	Steel panels, plywood or tongue and groove lumber

- B. Form materials which may remain or leave residues on or in the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

2.02 FORM AND FALSE WORK MATERIALS

- A. Materials for concrete forms, formwork, and false work shall conform to the following requirements:
1. Lumber shall be Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with U.S. Product Standard PS 20.
 2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Yellow Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.
 3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

2.03 FORM TIES

- A. Form ties with integral waterstops shall be provided with a plastic cone or other suitable means for forming a conical hole to ensure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form ties shall be Burke Penta-Tie System by The Burke Company; Richmond Snap-Tys by the Richmond Screw Anchor Company; or equal.
- B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used when approved by the Engineer. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie. Use Burke Taper-Tie System by The Burke Company; Taper-Ty by the Richmond Screw Anchor Company; or equal.

2.04 FORM COATING

- A. Non-grainrising and nonstaining resin or polymer type that will not leave residual matter on surface of concrete or adversely effect bonding to concrete of paint, plaster, mortar, protective coatings, waterproofing or other applied materials. Coatings containing mineral oils, paraffins, waxes or other nondrying

ingredients, are not permitted. For concrete surfaces contacting potable stored water, use only coatings and form-release agents that are completely nontoxic.

2.05 FORM JOINT SEALERS

- A. For joints between form panels, use resilient foam rubber strips, non-hardening plastic-type caulking compound free of oil, or waterproof pressure-sensitive plastic tape of minimum 8 mil thickness and 2 inches width. For form tie holes, use rubber plugs, plastic caulking compound, or equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the Work and replaced at no increased cost to the Owner. The Contractor shall provide worker protection from protruding reinforcement bars in accordance with applicable safety codes. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, false work, and shoring shall comply with applicable local, state and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, the Contractor shall continually monitor plumb and string line form positions and immediately correct deficiencies.
- B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.
- C. Unless otherwise indicated, exterior corners in concrete members shall be provided with $\frac{3}{4}$ inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.
- D. The Contractor shall notify the Engineer at least 48 hours prior to concrete placement so the completed formwork can be inspected.

- E. Final inspection will be made only after all formwork, embeds, blowouts, screeds, ties, final adjustments, and related work have been completed by the Contractor.
- F. The Contractor shall correct defective work identified by the Engineer, prior to delivery of the concrete.
- G. Neither the review of the Contractor's drawings nor inspection of forms by the Engineer shall relieve the Contractor of responsibility for the adequacy of the forms nor from the necessity for remedying all defects which may develop or become apparent with use. The Engineer may at any time condemn any section or sections of the forms found deficient. The Contractor shall promptly remove the condemned forms from the Work and replace them.

3.02 FORM DESIGN

- A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8 inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1- to 1-1/2 inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the Engineer. Whenever concrete cannot be placed from the top of a wall form in a manner that meets the requirements of the Contract Documents, form windows shall be provided in the size and spacing needed to allow placement of concrete to the requirements of Section 03300 - Cast-in-Place Concrete. The size, number, and location of such form windows shall be as acceptable to the Engineer.
- B. Wall Forms:
 - 1. All walls shall be formed by methods acceptable to the Engineer and to the correct elevations and location illustrated on the Plans.
 - 2. Pouring Openings:

- a) The minimum pouring opening size shall be 18" x 18".
- b) The bottom of the lower openings shall be no more than 48 inches from the top of the wall-footing.
- c) The horizontal centerline distance between such openings shall not exceed 96 inches nor shall the distance between the nearest opening and the bulkhead for the vertical joint exceed 36 inches.
- d) The vertical centerline distance between horizontal rows of openings shall not exceed 96 inches.
- e) Under no circumstances shall forming be such that the drop of concrete in the forms will exceed 4 feet in any one place.

3.03 CONSTRUCTION

- A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1 inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.
- B. Construction Joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.
- C. Form Ties:
 - 1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with non-shrink grout as specified for "Finish of Concrete Surfaces" in Section 03315 - Grout. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members.

2. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1 inch back from the formed face or faces of the concrete.
3. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2 inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

D. Embedded Items:

1. Before the placement of concrete within the forms, each trade having embedded items, including waterstops within the forms and affected by the pour, shall certify that all items are properly located and braced. This certification shall be provided by the Contractor to the Engineer at least 48 hours in advance of placement.

3.04 EMBEDDED PIPING AND ROUGH HARDWARE

- A. The Contractor shall consult with all trades which require openings for the passage of pipes, conduits and other inserts, and properly and accurately install the necessary pipe sleeves, anchors, or other required inserts, and properly size the equipment pads. The Contractor shall reinforce openings as indicated and required. The Contractor shall locate conduits or pipes so as not to reduce the strength of the construction, and in no case, place pipes, other than conduits in a slab 4-1/2 inches or less in thickness. The Contractor shall not embed conduit having an outside diameter greater than 1/3 of the thickness of the slab in a concrete slab, nor place conduit below bottom reinforcing steel or over top reinforcing steel. Conduits may be embedded in walls, provided they are not larger in outside diameter than 1/3 the thickness of the wall, are not spaced closer than three diameters on center, and do not impair the strength of the structure. The Contractor shall support embedded pipes and conduits independently from reinforcing steel in a manner to prevent metallic contact, and thereby, prevent electrolytic deterioration.

The Contractor shall place embedded pipes and conduits as nearly as possible to the centerline of the concrete section. The Contractor shall submit all conduit, piping and other wall penetrations, reinforcements and anchor bolt sizing and locations for review and approval.

3.05 REMOVAL OF FORMS

- A. Careful procedures for the removal of forms shall be strictly followed, and this Work shall be accomplished with care so as to avoid injury to the concrete. No heavy loading on green, insufficiently cured concrete will be permitted. In the case of roof slabs and above-ground floor slabs, forms for supported slab, but not shoring, shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28 day strength specified in Section 03300 - Cast-in-Place Concrete; provided, that no forms shall be disturbed or removed under an individual panel or until before the concrete in the adjacent panel or unit has attained 75 percent of the specified 28 day strength and has been in place for a minimum of 7 days. The time required to establish said strength shall be as determined by the Engineer from several test cylinders obtained by the Contractor for this purpose from concrete used in the first group of roof panels placed. If the time so determined is more than the 7 day minimum, then that time shall be used as the minimum length of time. Forms for all vertical walls and columns shall remain in place at least 2 days after the concrete has been placed. Forms for all parts of the Work not specifically mentioned herein shall remain in place for periods of time as determined by the Engineer.
- B. The Contractor shall not backfill against walls until the top slab is in place and all concrete has obtained compressive strength equal to the specified 28 day compressive strength.
- C. Immediately upon removal of the forms, the concrete surfaces shall be thoroughly wetted and shall be kept wet until the curing compound is applied or other curing procedure made effective, in accordance with the specification requirements.
- D. The Contractor shall assume the responsibility for damage resulting from improper and premature removal of forms.

3.06 REUSE OF FORMS

- A. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces.

Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be filled with non-shrink grout.

3.07 MAINTENANCE OF FORMS

- A Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, the forms shall be thoroughly cleaned. The form surfaces shall be treated with a non-staining mineral oil or other lubricant acceptable to the Engineer. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the Contractor shall perform the oiling at least 2 weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.08 FALSE WORK

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

3.09 REMOVAL OF SHORING AND FALSE WORK

- A The Contractor shall not remove shoring and false work until 21 days after concrete placement, or concrete has attained at least 90 percent of the 28 day design compressive strength as demonstrated by control test cylinders, but not sooner than 14 days. If testing is completed to review the 90 percent compressive strength, the Contractor shall incur the cost.

3.10 LOAD RESTRICTION

- A The Contractor shall not impose construction, equipment or permanent loads on columns, supported slabs, or supported beams until concrete has attained the 28 day design compressive strength.

END OF SECTION 03100

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Division 26 - Electrical: Grounding connection to concrete reinforcement.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete; 2016.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
 - 1. Use 2014 as indicated in 2016 CBC Ch 35 Referenced Standards.
- C. ACI SP-66 - ACI Detailing Manual; 2004.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
 - 1. Use 2012 as indicated in 2016 CBC Ch 35 Referenced Standards.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
- F. CRSI (DA4) - Manual of Standard Practice; 2009.
- G. CRSI (P1) - Placing Reinforcing Bars; 2011.

1.04 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Product Data:
 - 1. Reinforcement supporting and spacing devices at exposed concrete only, to demonstrate non-corroding and non-staining characteristics.
 - 2. Adhesive compounds.
- C. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- D. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
- E. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

- F. **Quality Control Submittals:** Submit the following information related to quality assurance requirements specified:
1. **Certifications:** Submit to the testing laboratory mill test certificates for all reinforcing steel, showing physical and chemical analysis. If steel is to be welded, include in chemical analysis the percentages of carbon, manganese, copper, nickel, and chromium, and optionally the percentages of molybdenum and vanadium.
 2. **Certifications:** If steel is to be welded, submit certifications to the testing laboratory signed by AWS Certified Welding Inspector (CWI) of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualification of welding operators, and qualification of welders.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, and ACI 318.
 1. Maintain one copy of each document on project site.
- B. **Regulatory Requirements:** Conform to California Building Code (CBC) Title 24 Part 2, Chapter 19A requirements as amended and adopted by authorities having jurisdiction, for details of reinforcement.
- C. Provide Architect, Project Inspector, and Special Inspector with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

1.06 DELIVERY, STORAGE AND HANDLING

- A. **Delivery:** Deliver reinforcement bars new and free from rust and mill scale in original bundles marked with durable identification tags.
- B. **Storage:** Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening coatings.
- C. **Handling:** Take precautions to maintain reinforcement identification after bundles are broken.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. **Reinforcing Steel:** ASTM A615/A615M, Grade 60 (60,000 psi).
 1. Deformed billet-steel bars.
 2. Unfinished.
- B. **Stirrup Steel:** ASTM A1064/A1064M steel wire, unfinished.
- C. **Reinforcement Accessories:**
 1. **Tie Wire:** Annealed, minimum 16 gage, 0.0508 inch.
 2. **Chairs, Bolsters, Bar Supports, Spacers:** Wire-bar-type devices, complying with 1, for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Sized and shaped for adequate support of reinforcement during concrete placement.

- a. Supports at Slab on Grade: Provide devices with load-bearing pads or horizontal runners where base material does not support chair legs, to prevent puncture of vapor retarder/barrier or provide precast concrete block bar supports of equal or greater strength to specified concrete.
- b. Corrosion Resistance:
 - 1) Provide stainless steel or plastic components for placement within 1-1/2 inches of weathering surfaces.
 - (a) Provide plastic coated, plastic-tipped (CRSI, Class 1) or stainless steel types at exposed-to-view concrete surfaces.
 - (b) Provide only stainless steel (CRSI Class 2) at exterior exposed surfaces to be painted.

2.02 RE-BAR SPLICING:

- A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing 160% of steel reinforcing design strength in tension and compression.
- B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; Type II capable of developing 160% of steel reinforcing design strength in tension and compression.

2.03 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Locate reinforcing splices not indicated on drawings at point of minimum stress. See Structural Drawings,
 - 1. Review locations of splices with Architect (Structural Engineer) before fabrication and placement. .

PART 3 EXECUTION

3.01 PREPARATION

- A. Cleaning: Clean reinforcement to remove loose rust and mill scale, soil, and other materials which may reduce or destroy bond with concrete.
- B. Adjustment and Inspection: Do not bend or straighten reinforcement in a manner injurious to material. Do not use bars with kinks or bends not shown on Drawings and reviewed shop drawings, or bars with reduced cross-section due to corrosion or other cause.
- C. Do not bend bars No. 5 and larger in the field.
- D. Do not bend bars more than once in the same location.

3.02 PLACEMENT

- A. General: Place and secure reinforcement as specified herein, as indicated and noted on Drawings and in compliance with recommended details and methods of reinforcement placement and support specified in CRSI Placing Reinforcing Bars.
- B. Place, support and secure reinforcement against displacement. Do not deviate from required position.
 - 1. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

- C. Do not displace or damage vapor barrier.
- D. Accommodate placement of formed openings.
- E. Maintain concrete cover around reinforcing as indicated on Structural Drawings:
- F. Comply with applicable code for concrete cover over reinforcement.
 - 1. If not otherwise indicated on Drawings or specified herein, provide concrete cover in compliance with 1.
- G. Bond and ground all reinforcement to requirements of Division 26.
- H. Coordination: Locate reinforcement to accommodate embedded products and formed openings and recesses.
- I. Slab on Grade Reinforcement: Do not displace or damage vapor retarder/barrier at slab on grade.
- J. Wire Reinforcement Placement: Place reinforcement in sheets as long as practicable, lapping adjoining pieces at least one full mesh and lace splices with 16 gage wire. Offset end laps in adjacent widths to prevent continuous laps. Extend reinforcement to within 1-inch of edge at slabs on grade. Cut mesh at expansion joints and full depth control joints.
- K. Dowels: Secure tie dowels in place before depositing concrete. Provide No. 3 bars for securing dowels where no other reinforcement is provided.
- L. Reinforcement Splices, General: Provide standard reinforcement splices by lapping ends, placing bars in contact and tightly wire tying. Comply with details and requirements of 1 for minimum lap of spliced bars and criteria indicated on the Drawings.
 - 1. Clearances for Splices: Wherever possible, provide minimum 1-1/2 inch clearance between sets of splices. Stagger horizontal bars so that adjacent splices are minimum 48 inches apart.
- M. Reinforcement Supports: Support reinforcement on metal chairs, spacers or metal hangers to provide required coverage and to properly locate reinforcement. Do not use wood. Avoid cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
 - 1. Support Spacing: Space chairs and accessories in conformance with CRSI Placing Reinforcing Bars.
- N. Corrections During Concrete Placement: Maintain reinforcing steel workers on-site during placement of concrete for resetting reinforcement displaced by runways, workers and other causes.

3.03 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 40 00, will inspect installed reinforcement for conformance to contract documents before concrete placement.
 - 1. Concrete floor slabs on grade are to be continuously inspected as recommended in the geotechnical report.
- B. Inspector of Record, as specified in Section 01 45 33 - Code Testing, Special Inspections and Procedures, will inspect installed reinforcement for conformance to contract documents before concrete placement.

1. Concrete floor slabs on grade are to be continuously inspected as recommended in the geotechnical report.
- C. Defective Reinforcement Work: The following shall be considered defective and may be ordered to be removed and reconstructed at no change in Contract Time or Sum.
1. Bars with kinks or bends not shown on Drawings.
 2. Bars injured due to bending or straightening.
 3. Bars heated or bent.
 4. Reinforcement not placed in accordance with Drawings and Specifications.
 5. Rusty or oily bars.
 6. Bars exposed in surface of concrete or without adequate concrete cover.

END OF SECTION

SECTION 03 22 00
UNDERSLAB VAPOR BARRIER

PART 1 -- GENERAL

1.01 DESCRIPTION

- A. This Section describes the requirements for furnishing and installing moisture barrier and sand under concrete slabs-on-grade.
- B. Related Sections:
 - 1. Prepare subgrade according to Soils Report.
 - 2. Concrete is specified in Section 03 30 00.

1.02 SUBMITTALS

- A. Submit in accordance with Section 01 30 00 – Contractor Submittals of the Specifications.
- B. Product Data: Include independent laboratory test results showing compliance with ASTM and ACI Standards. Include manufacturer's installation instructions for placement, seaming, and pipe boot installation.

1.03 SUBSTITUTIONS

Substitutions will not be allowed unless otherwise specified on the plans or approved during the submittal phase by the Construction Manager.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

Protect products against damage during field handling and installation.

PART 2 -- PRODUCTS

2.01 MANUFACTURERS

- A. Stego Wrap Vapor Retarder by Stego Industries
- B. Vapor-Block by Raven Industries
- C. Architect approved equal

2.02 MATERIALS

- A. Vapor Retarder must have the following qualities:
 - 1. 10 mil thickness minimum.
 - 2. Permeance of 0.01 UP perms as tested by ASTM E154.
 - 3. Puncture resistance of 2,600 grams per ASTM D1709, Method B.
 - 4. ASTM E 1745 Class A (Plastics) after conditioning testing.
- B. Vapor Retarder Tape:
 - 1. Water Vapor Transmission Rate :ASTM E 96, 0.3 perms or lower
 - 2. Minimum 8-mils thick
 - 3. Minimum 4 inches wide

4. Manufactured from High Density Polyethylene
5. Pressure Sensitive Adhesive
- C. Pipe Boots: Construct from vapor barrier sheeting material and pressure sensitive tape in accordance with manufacturer's instructions.
- D. Sand: Clean yard sand, free from excessive dirt, debris, organic matter, and fines smaller than No. 200 sieve size.

PART 3 -- EXECUTION

3.01 INSPECTION

- A. Below grade and grading work and items penetrating moisture barrier shall be completed prior to start of installation.
- B. Examine the areas and conditions under which work of this Section will be performed.
- C. Correct conditions detrimental to timely and proper completion of the Work.
- D. Do not proceed until unsatisfactory conditions are corrected.
- E. Beginning of installation means acceptance of conditions.

3.02 INSTALLATION REQUIREMENTS

- A. Vapor Barrier Sheeting:
 1. Install in accordance with manufacturer's instructions and ASTM E1643.
 2. Unroll with the longest dimension parallel with the direction of the pour.
 3. Lap vapor barrier over footings and seal to foundation walls.
 4. Overlap joints 6-inches and seal with pressure sensitive tape.
 5. Seal penetrations, including pipes, with pipe boot.
 6. Penetrations through vapor barrier sheeting except for reinforcing steel and permanent utilities are not permitted.
 7. Repair damaged areas by cutting patches of vapor barrier sheeting, overlapping damaged area 6-inches and taping all four sides with pressure sensitive tape.
- B. Sand Cushion:
 1. Provide 2-inch layer over moisture barrier, unless otherwise indicated.
 2. Spread over surfaces required and work to fill voids; leave in stable condition with finished surfaces reasonably uniform at established grade.

*****END OF SECTION*****

SECTION 03 29 00
JOINTS IN CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall provide joints in concrete at the locations indicated, complete, in accordance with the Contract Documents.
- B. Waterstops shall be provided in all construction and expansion joints of hydraulic or below grade structures unless specifically noted otherwise in the Contract Documents.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of the Work.
 - 1. Section 03100 - Concrete Formwork
 - 2. Section 03200 - Reinforcement Steel
 - 3. Section 03300 - Cast-in-Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Except as otherwise indicated in this Section, the Contractor shall comply with the latest adopted edition of the Standard Specifications for Public Works Construction (SSPWC), together with the latest adopted editions of the Regional Amendments.
- B. The current edition of the Uniform Building Code (UBC) of International Conference of Building Officials (ICBO).
- C. National Sanitation Foundation
 - 1. NSF / ANSI 61: Drinking Water System Components – Health Effects
- D. Federal Specifications (Current Edition):
 - 1. TT-S-0227E(3): Sealing Compound, Elastomeric Type, Multi-Component for Caulking, Sealing, and Glazing Buildings and Other Structures.

2. SS-S-210A: Sealing Compound for Expansion Joints.
- E. U.S. Army Corps of Engineers Specifications:
1. CRD-C572: PVC Waterstop.
- F. ASTM Standards in Building Codes (Current Edition):
1. ASTM A 775: Specification for Epoxy-Coated Reinforcing Steel Bars
 2. ASTM C 920: Specification for Elastomeric Joint Sealants
 3. ASTM D 412: Test Methods for Rubber Properties in Tension
 4. ASTM D 624: Test Method for Rubber Property - Tear Resistance
 5. ASTM D 638: Test Method for Tensile Properties of Plastics
 6. ASTM D 746: Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
 7. ASTM D 747: Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
 8. ASTM A 775: Specification for Epoxy-Coated Reinforcing Steel Bar
 9. ASTM D 1056: Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
 10. ASTM D 1752: Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
 11. ASTM D 2000: Standard Classification System for Rubber Product in Automotive Applications
 12. ASTM D 2240: Test Method for Rubber Property - Durometer Hardness
 13. ASTM D 2241: Specification for Poly Vinyl Chloride (PVC) Pressure-Related Pipe (SDR-series)

1.04 TYPES OF JOINTS

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

first pour may also be required to receive a coating of bond breaker as indicated.

- B. Contraction Joints: Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and/or sealant groove shall also be provided unless otherwise indicated on the Plans.
- C. Expansion Joints: To allow the concrete to expand freely, a space is provided between the two pours; the joint shall be formed as indicated. This space is obtained by placing a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise indicated, all expansion joints in water bearing members shall be provided with a center-bulb type waterstop.
- D. Control Joints: The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will likely occur. A groove, of the shape and dimensions indicated, is formed or saw-cut in the concrete. This groove is filled afterward with a joint sealant material as specified.

1.05 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit the following in compliance with Contractor Submittals:
 - 1. Waterstops: Before production of the required materials, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used, and shall be accomplished so that the material and workmanship represents in all respects the material to be provided under this Contract. The balance of the material to be used under this Contract shall not be produced until after the Engineer has reviewed the qualification samples.
 - 2. Joint Sealant: Before ordering the sealant material, the Contractor shall submit sufficient data to show general compliance with the requirements of the Contract Documents.
 - 3. Before the sealant is used on the job, the Contractor shall submit certified test reports from the sealant manufacturer on the actual batch of material being supplied indicating compliance with the above requirements.

4. Shipping Certification: The Contractor shall furnish written certification from the manufacturer as an integral part of the shipping form, to show that all of the material shipped to this project meet or exceed the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.
5. Joint Location: The Contractor shall submit placement shop drawings illustrating the location and type of all joints for each structure.

1.06 QUALITY ASSURANCE

- A. Waterstop Inspection: All waterstop field joints shall be subject to rigid inspection, and no such work shall be scheduled or started without the Contractor having made prior arrangements with the Engineer to provide for the required inspections. Not less than 48 hours' notice shall be given to the Engineer for scheduling such inspections.
- B. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the Contractor at no increase in cost to the Owner.
- C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:
 1. Offsets at joints greater than 1/16 inch or 15 percent of material thickness, at any point, whichever is less.
 2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16 inch or 15 percent of material thickness, at any point, whichever is less.
 3. Any combination of offset or exterior crack which will result in a net reduction in the cross-section of the waterstop in excess of 1/16 inch or 15 percent of material thickness, at any point, whichever is less.
 4. Misalignment of joint which result in misalignment of the waterstop in excess of 1/2-inch in 10 feet.
 5. Porosity in the welded joint as evidenced by visual inspection.
 6. Bubbles or inadequate bonding which can be detected with a penknife test. If, while prodding the entire joint with the point of a penknife, the

knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.

- D. Waterstop Samples: Before use of the waterstop material in the field, a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used shall be submitted to the Engineer for review. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be provided under this Contract. Field samples of fabricated fittings will be selected at random by the Engineer for testing by a laboratory at the Contractor's expense. When tested, PVC waterstops shall have a tensile strength across the joints equal to at least 600 PSI.
- E. Construction Joint Sealant: The Contractor shall prepare adhesion and cohesion test specimens as indicated, at intervals of 5 working days while sealants are being installed.
- F. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:
 - 1. Sealant specimens shall be prepared between two concrete blocks (1 inch to 2 inches by 3 inches). Spacing between the blocks shall be 1 inch. Coated spacers (2 inches by 1 ½ inch by ½ inch) shall be used to ensure sealant cross-sections of ½ inch by 2 inches with a width of 1 inch.
 - 2. Sealant shall be cast and cured according to manufacturer's recommendations except that the curing period shall be not less than 24 hours.
 - 3. Following curing period, the gap between blocks shall be widened to 1-1/2 inch. Spacers shall be used to maintain this gap for 24 hours before inspection for failure.

1.07 WARRANTY

- A. The Contractor shall furnish a 5 year written warranty of the entire sealant installation against faulty and/or incompatible materials and workmanship, along with a statement that it agrees to repair or replace, to the satisfaction of the Owner and at no additional cost to the Owner, any defects that appear during the warranty period.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All joint materials specified herein shall be classified by the Environmental Protection Agency as acceptable for potable water use.

2.02 PVC WATERSTOPS

- A. General: Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications. No reclaimed or scrap material shall be used. The Contractor shall obtain from the waterstop manufacturer and submit to the Engineer current test reports and a written certification that the material to be shipped meets the physical requirements outlined in the U.S. Army Corps of Engineers Specification CRD-C572 and those listed herein.
- B. Flatstrip and Center-Bulb Waterstops: At no place shall the thickness of flatstrip waterstops, including the center-bulb type, be less than 3/8 inch. Flatstrip and center-bulb waterstops shall be manufactured by Kirkhill Rubber Co., Brea, California; Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal.
- C. Multi-Rib Waterstops: Multi-rib waterstops, where required, shall be manufactured by Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal. Prefabricated joint fittings shall be used at all intersections of the ribbed-type waterstops.
- D. Other Types of Waterstops: When other types of waterstops not listed above are required and indicated, they shall be subjected to the same requirements as those listed herein.
- E. Waterstop Testing Requirements: When tested in accordance with the standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value	ASTM Std.
Tensile Strength-min (PSI)	1,750	D 638, Type IV
Ultimate Elongation-min (%)	350	D 638, Type IV
Low Temp Brittleness-max (degrees F)	-35	D 746
Stiffness in Flexure-min (PSI)	400	D 747
Accelerated Extraction (CRD-C572)		
Tensile Strength-min (PSI)	1,500	D 638, Type IV
Ultimate Elongation-min (%)	300	D 638, Type IV

Effect of Alkalies (CRD-C572)

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

Finish Waterstop

Tensile Strength-min (PSI)	1,400	D 638, Type IV
Ultimate Elongation-min (%)	280	D 638, Type IV

2.03 JOINT SEALANT

A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.

B. Joint sealant material shall meet the following requirements (73°F and 50% relative humidity):

Work Life	45 - 180 minutes
Time to Reach 20 Shore "A" Hardness (at 77°F, 200 gr quantity)	24 hours, maximum
Ultimate Hardness (ASTM D 2240)	20 - 45 Shore "A"
Tensile Strength (ASTM D 412)	200 PSI, minimum
Ultimate Elongation (ASTM D 412)	400%, minimum
Tear Resistance (Die C ASTM D 624)	75 pounds per inch of thickness, minimum
Color	Light Gray

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

1. Sealant shall be two-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ANSI/ASTM C 920 or Federal Specification TT-S-0227 E(3) for two-part material, as applicable.

2. For vertical joints and overhead horizontal joints, only “nonsag” compounds shall be used; all such compounds shall conform to the requirements of ANSI/ASTM C 920 Class 25, Grade NS, or Federal Specification TT-S-0227 E(3), Type II, Class A.
 3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ANSI/ASTM C 920 Class 25, Grade P, or Federal Specification TT-S-0227 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing nontracking characteristics, and having a Shore “A” hardness range of 35 to 45, shall be used.
 4. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.
- D. All sealants, wherever shown, or required hereunder shall be PSI-270 as manufactured by Polymeric Systems Inc.; Elastothane 227R as manufactured by Pacific Polymers; Sikaflex 2C, as manufactured by Sika Corporation, or equal.
- E. Sealants for nonwaterstop joints in concrete shall conform to the requirements of Section 07900 – Sealants and Caulking.

2.04 JOINTS MATERIALS

- A. Bearing Pad: Bearing pad to be neoprene conforming to ASTM D 2000 BC 420, 40 durometer hardness unless otherwise indicated.
- B. Neoprene Sponge: Sponge to be neoprene, closed-cell, expanded, conforming to ASTM D 1056, Type 2C3-E1.
- C. Joint Filler:
1. Joint filler for expansion joints in water holding structures shall be neoprene conforming to ASTM D 1056, Type 2C5-E1.
 2. Joint filler material in other locations shall be of the preformed nonextruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All nonextruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 for Type I, except as otherwise indicated.

2.05 BACKING ROD

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

2.06 BOND BREAKER

- A. Bond breaker shall be Super Bond Breaker as manufactured by Burke Company, San Mateo, California; Select Cure CRB as manufactured by Select Products Co., Upland, California, or equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable.

2.07 SLIP DOWELS

- A. Slip dowels in joints shall be A 36 smooth epoxy-coated bars, as indicated on the Plans, and conforming to ASTM A 775.

2.08 PVC TUBING

- A. PVC tubing in joints shall be Schedule SDR 13.5, conforming to ASTM D 2241.

2.09 NSF / ANSI STANDARD 61

- A. All cementitious material, admixtures, curing compounds, and other industrial produced materials used in concrete, or for curing or repairing of concrete, that can contact potable water or water that will be treated to become potable shall be listed in NSF / ANSI Standard 61.

PART 3 - EXECUTION

3.01 GENERAL

- A. Waterstops of the type indicated shall be embedded in the concrete across joints as indicated. All waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of manufacturer of the waterstops. The Contractor shall take suitable precautions and means to support and protect the waterstops during the progress of the Work and repair or replace at its own expense any waterstops damaged during the progress of the Work. All waterstops shall be stored so as to permit free circulation of air around the waterstop material.
- B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for

more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.02 SPLICES IN WATERSTOPS

- A. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that:
 - 1. The material not be damaged by heat sealing.
 - 2. The splices have a tensile strength of not less than 60% of the unspliced material's tensile strength.
 - 3. The continuity of the waterstop ribs and of its tubular center axis be maintained.
- B. Butt joints of the ends of two identical waterstop sections may be made while the material is in the forms.
- C. All joints with waterstops involving more than two ends to be joined together, and all joints which involve an angle cut, alignment change, or the joining of two dissimilar waterstop sections shall be prefabricated before placement in the forms, allowing not less than 24 inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24 inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.
- D. Where a centerbulb waterstop intersects and is joined with a noncenterbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.03 JOINT CONSTRUCTION

- A. Setting Waterstops: To eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions shall be made to support and anchor the waterstops during the progress of the Work and to ensure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be ensured by thoroughly working it in the vicinity of all joints.

- B. In placing flat-strip waterstops in the forms, a means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise indicated, all waterstops shall be held in place with light wire ties on 12 inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.
- C. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.
- D. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to a future concrete placement.
- E. Joint Location: Construction joints, and other types of joints, shall be provided where indicated. When not indicated, construction joints shall be provided at 25 foot maximum spacing for all concrete construction, unless noted otherwise. The location of all joints, of any type, shall be submitted for acceptance by the Engineer.
- F. Joint Preparation: Special care shall be used in preparing concrete surfaces at joints where bonding between two sections of concrete is required. Unless otherwise indicated, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03300 - Cast-in-Place Concrete.
- G. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.
- H. The space so formed shall be filled with a joint sealant material as specified. In order to keep the two wall or slab elements in line the joint shall also be provided with a sleeve-type dowel, unless otherwise indicated on Plans.
- I. Construction Joint Sealant: Construction joints in water-bearing floor slabs, and elsewhere as indicated, shall be provided with grooves, which shall be filled with a construction joint sealant. The material used for forming the grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint

sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sandblasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the joint sealant. The primer used shall be supplied by the same manufacturer supplying the sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant filler shall be thoroughly cleaned, as outlined for the grooves, before application of the sealant.

- J. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant before application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. All sealant shall achieve final cure at least 7 days before the structure is filled with water.
- K. All sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations. Before Work is commenced, the crew performing the Work shall be instructed as to the proper method of application by a representative of the sealant manufacturer.
- L. Thorough, uniform mixing of two-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, arrange to have the crew performing the Work carefully instructed as to the proper method of mixing and application by a representative of the sealant manufacturer.
- M. Any joint sealant which, after the manufacturer's recommended curing time for the job conditions of the Work hereunder, fails to fully and properly cure shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be resealed with the indicated joint sealant. All costs of such removal, joint treatment, resealing and appurtenant work shall be at no additional cost to the Owner.

END OF SECTION 03290

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

The work includes the furnishing and installing of all cast-in-place concrete work including formwork and reinforcement as shown and noted on the drawings and as specified. The General Conditions and Division 1 apply to this section as fully as if repeated herein.

1.02 APPLICABLE STANDARDS (latest editions apply)

A. ACI- American Concrete Institute:

1. 301, Specifications for Structural Concrete for Buildings.
2. 305, Recommended Practice for Cold Weather Concreting.
3. 306, Recommended Practice for Hot Weather Concreting.
4. 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
5. 318, Building Code Requirements for Reinforced Concrete.
6. 347, Recommended Practice for Concrete Formwork.

B. ASTM- American Society of Testing and Materials, Referenced Standards

C. AWS- American Welding Society:

1. AD1.4 Structural Welding Code- Reinforcing Steel
2. A5.1 Mild Steel Covered Arc-Welding Electrodes

D. CRSI-Concrete Reinforcing Steel Institute:

1. Manual of Standard Practice
2. Recommended Practice for Placing Reinforcing Bars

E. ICC- International Code Council:

1. CBC – 2019 California Building Code (California Code of Regulations, Title 24, Part 2)

1.03 SUBMITTALS

A. Concrete Mix Design and Tests:

1. Submit mix designs and compressive strength test reports from previous applications for specified types of concrete.

2. One copy of all test reports shall be forwarded to DSA, the Architect, the Structural Engineer, the Inspector of Record within fourteen days of the test. Test reports shall comply with all requirements of CCR Title 24, Part 1, Section 4-335.
3. The concrete mixes shall be based on designs of a professional testing laboratory, verified by test, also in accordance with CBC Section 1905A.3 or 1905A.4.

B. Concrete Shop Drawings:

1. Joints not shown on the drawing shall be so made and located as to least impair the strength of the structural elements and shall be submitted for approval to the Owner and Structural Engineer.

C. Reinforcing Steel Shop Drawings and Mill Reports:

1. Shop Drawings of all reinforcing steel shall be submitted for approval.
2. Mill Reports for each different heat to be used on the job shall be submitted for approval. Comply with CBC, Section 1916A.2.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Except as modified by the requirements specified herein or the details indicated, concrete construction shall conform to the California Code of Regulations (CCR), Title 24, Chapter 19.
- C. Provide access for, and cooperate with, the inspector and testing laboratory described in Section 01 45 33 of these Specifications.
- D. Welders shall be qualified in accordance with AWS D1.4.

1.05 LABORATORY TESTS AND MIX DESIGNS

- A. General: Compression tests of concrete shall be performed by a qualified testing laboratory in accordance with Section 01 45 33.
- B. Compression Test: See Section 01 45 33, Code-Required Special Inspections and Procedures.
- C. Mix Designs:
 1. Mix designs shall be prepared by the Testing Laboratory of record under the supervision of a California Registered Civil Engineer, who shall determine mix designs to fulfill the specified requirements for strength, aggregate size and workability of concrete, and such designs shall be used in proportioning all structural concrete. Mix designs shall bear the signature of the Registered Civil Engineer. Two copies of the mix design shall be submitted to the Architect as a matter of record, and not for approval.

2. Mix designs shall be made in accordance with ACI 318-14, Chapters 3, 4 and 5 and Title 24 Part 2, Section 1904. Cost of mix designs will be paid for by the Owner.
3. Cover and clear distances between reinforcing bars shown on the drawings shall be considered in determining the aggregate size for mix designs, which may result in an aggregate size smaller than the maximum aggregate size stipulated elsewhere in this specification.
4. A list specifying the intended usage of each mix design shall be clearly shown as part of the designs.

PART 2 PRODUCTS

2.01 FORMS:

- A. Unless otherwise indicated, materials for formwork shall be wood, steel, fiber or reinforced plastic and of suitable quality to achieve required finishes. Contractor shall conform with considerations and recommendations in ACI-347, Chapter 3, Materials for Formwork.
- B. Unless otherwise indicated, contact surfaces in fabricated forms shall be smooth and uniform without warps, bends, dents, sags or irregular absorptive conditions and imperfections which might telegraph or product objectionable irregularities in the exposed concrete finish.
- C. Forms for Unexposed Concrete: Form concrete surfaces which will not be exposed in the finished structure with plywood, lumber, metal or other acceptable material.
- D. Lumber: Standard or better grade Douglas fir. Use boards which are surfaced on at least 2 edges and one side for a tight fit.
- E. Plywood: High Density Overlay Plyform, Class I, Exterior grade meeting the requirements of PS 1-07, 5/8 inch minimum thickness for 12 inch stud spacing and 3/4 inch minimum thickness for 16 inch stud spacing.
- F. Forms for Exposed Finish Concrete: Construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- G. Form Ties and Spreaders: Standard metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete faces that will be exposed to view, painted, damp proofed or waterproofed. Inner tie rod shall be left in concrete when forms are removed. Wire ties or wood spreaders will not be permitted. Form ties and spreaders shall leave a hole not larger than 7/8-inch nor less than 1/2-inch in diameter in the concrete surface.
- H. Design, erect, support, brace, and maintain formwork so it will safely support vertical and lateral loads which might be applied until such loads can be supported safely by concrete structure.
- I. Construct forms to the exact sizes, shapes, lines, and dimensions shown, and as required to

obtain accurate alignment, location, grades, and level and plumb work in the finished structure. All exposed edges shall be chamfered with triangular fillets ½-inch by ½-inch.

- J. Form Coatings: Form coating and bond breaking materials shall be non-staining and completely compatible with finish materials and other surface treatment materials to be used.

2.02 VAPOR BARRIER:

Under all floor slabs to receive carpet, wood, sheet flooring materials, rubber or other moisture sensitive topping, install a vapor barrier of 15 mil polyolefin sheeting with a minimum puncture resistance of 4,000 grams. VaporBlock15 by Raven Industries, Stego Wrap 15-Mil by Stego Industries, LLC, Perminator by WR Meadows or approved equal. Lap joints 6".

2.03 REINFORCEMENT:

A. Comply with the following as minimums:

1. Bars: ASTM A615/A615M, Grade 60 or ASTM A706 unless otherwise noted. Use deformed bars for No. 3 and larger.
2. Bending: ACI 318.
3. Tie wires and spirals: ASTM A82.
4. Reinforcement supports:
 - a. At reinforcing placed over sand or earth, use precast concrete cubes.
 - b. At reinforcing placed over forms, provide supports with legs which are hot dip galvanized, stainless steel or plastic protected.
5. Mechanical Bar Splice: Xtender by Headed Reinforcement Corp. or equal to develop a minimum of 125% of yield strength of bar.

B. Fabricate steel reinforcement in accordance with the details indicated. Where specific details are not indicated or noted, comply with the applicable requirements of CCR Title 24, Chapter 19, ACI 318, Section 7 and ACI SP-66(04). Reinforcing steel shall be cleaned, fabricated, placed, tied and supported in accordance with ACI 301 and ACI 315.

C. Do not use reinforcement having any of the following defects:

1. Bar lengths, depths, or bends exceeding the specified fabrication tolerances.
2. Bends or kinks not indicated on the Drawings or required for this Work.
3. Bars with cross-section reduced due to excessive rust or other caused.

2.04 CONCRETE:

A. Portland Cement: ASTM C150, type II, low alkali.

B. Regular Weight Concrete Aggregates: ACI 318: 3.3.2 as modified by CCR Title 24 Part 2, Sec. 1903A.6.

1. Fine Aggregate: Washed clean, uniformly screen graded, and containing not more than 2 percent by weight of deleterious materials such as shale, schist, alkali, clay, lumps, earth, loam, mica, or similar materials. Uniformly grade fine aggregate from fine to coarse.

2. Coarse Aggregate: Clean, hard, crushed rock or washed gravel, free from organic materials or soft or friable materials, containing not more than 2 percent by weight of shale or cherty material and not more than 15 percent by weight of elongated fragments.
- C. Fly ash and natural pozzolans used in concrete: Mixes utilizing fly ash or natural pozzolans shall be per CCR, Title 24, Part 2, Section 1903.5.
- D. Water: Clean and potable.
- E. Admixtures: ACI 318: 3.6, of a type that increases workability and reduces water demand of concrete, but will not increase shrinkage. Admixture shall be subject to acceptance by the Architect and Division of the State Architect as to type and amount used. Admixtures shall contain not more than one percent chloride ions.
- F. Provide concrete with the compressive strengths shown on the Drawings. When such strengths are not shown on the Drawings, provide the following as minimums:
 1. Concrete Foundations, Pads and Walls: 3000 psi
 2. Slabs on Grade: 3000 psi
- G. Surface curing treatment: Curing Compound, ASTM C 309, liquid membrane forming, with fugitive dye for identification. Compound shall be compatible with finishes to be applied to concrete. Curing Compound and areas receiving it are subject to acceptance by the Architect. Where a concrete sealer is scheduled on the drawings, use sealer material specified as the curing compound.
- H. Vapor Control Sealer: Water based, resin compound containing not less than 36 percent solids, designed to cure, seal and restrict water vapor emission for interior slabs to receive resilient, carpet, wood, rubber and sheet flooring products. Flooring products shall be warranted for a period of 15 years warranty. Acceptable products:
 - Bostik; D250
 - Diamond Stone; MTP
 - Synthetics International; Syn10
- I. Clear Sealer Hardener: For interior slabs to remain exposed. Install a colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 pounds of fluosilicates per gallon. Acceptable products or equal:
 - Nox-Crete Chemicals Inc.; Harbeton
 - Sonneborn Building Products: Lapidolith
 - Protex Industries; Lithoplate

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

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

3.02 REINFORCING

- A. Comply with the drawings and applicable requirements of the CCR Title 24, Part 2 and ACI 318, as well as the specified standards, for details and methods of reinforcing placement and supports.
1. Clean reinforcement and remove loose dust and mill scale, earth, and other materials which reduce bond or destroy bond with concrete.
 2. Position, support, and secure reinforcement against displacement by forms, construction, and the placement operations.
 3. Place reinforcement to obtain the required coverages for concrete protection.
 - a. Where concrete is deposited against ground 3"
 - b. Concrete in forms exposed to earth or weather 2"
 4. The clear spacing between parallel bars shall be not less than 1-1/2 times the normal diameter of the maximum size aggregate, and in no case less than 1-1/2 inches, except at splices which may be wired together.
 5. Unless otherwise shown on the Drawings, or required by the above referenced codes, lap bars 24 inches minimum.
 6. Do not bend or straighten reinforcing in any manner that will injure the material.
 7. Install splices for reinforcing bars in accordance with drawings and ACI 318. Stagger splices in adjacent bars 5' – 0".

3.03 EMBEDDED ITEMS

- A. Do not embed piping, other than electrical conduit, in structural concrete.
1. Locate conduit to maintain maximum strength of the structure.
 2. Increase the thickness of the concrete if the outside diameter of the conduit exceeds 30% of the thickness of the concrete.
- B. Set bolts, inserts, and other required items in concrete accurately secured so they will not be displaced, and in precise locations needed.

3.04 SOURCE QUALITY CONTROL

General: Submit mill tests and manufacturer's certification of compliance with ASTM Specifications to the Inspector in lieu of testing of cement and aggregate analysis.

3.05 FIELD QUALITY CONTROL

- A. Contractor shall examine placement of all reinforcement and embedded items prior to inspection by Owner's Testing Agency to ensure the proper clearances have been maintained and that all reinforcement and inserts are firmly tied to resist displacement.

- B. Contractor shall notify the Owner's Inspector at least 24 hours ahead of each concrete pour, and no concrete shall be placed until all reinforcing steel has been installed and approved by the Inspector. All reinforcing shall be complete in every way by the end of the working day prior to concrete placing. Testing and Inspections are specified in Section 01 45 33.
- C. The Owner's Testing Agency will inspect
 - 1. In-place reinforcing steel
 - 2. Field welding of reinforcing steel
- D. Contractor shall notify the Architect two working days in advance of concrete placement.

3.06 MIXING

All concrete shall be ready-mixed concrete and shall be mixed and delivered in accordance with the requirements of "Specifications for Ready-Mixed Concrete", ASTM C94. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept at a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first class condition and kept in constant rotation during delivery. No water shall be added during transit or at the job without specific approval of the Architect. Concrete shall be placed within 90 minutes after addition of water and admixtures.

3.07 PLACING CONCRETE

A. Preparation

- 1. Subgrade Preparations:
 - a. Before concrete floor slabs on grade are poured, place vapor barrier over prepared subgrade, up footings and columns and lap all joints not less than 6 inches. Seal all penetrations and pipes in accordance with manufactures instructions. Repair punctures, holes and damage prior to concrete placement using 4" wide pressure sensitive tape. Pour concrete directly on the vapor barrier surface without the use of sand in accordance with ACI 302.R1 flow chart.
 - b. All sleeves, inserts, anchors and embedded items required for adjoining work or for its support shall be placed prior to concreting. Embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts and anchor bolt slots shall be filled temporarily with a readily removable material to prevent entry of concrete into the voids.
- 2. Remove foreign matter accumulated in the forms.
- 3. Rigidly close openings left in the formwork.
- 4. Wet wood forms sufficiently to tighten up cracks. Wet other material sufficiently to maintain workability of the concrete.
- 5. Use only clean tools.

B. Conveying

- 1. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.

2. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to re-handling and flowing.
 3. Do not use concrete which becomes non-plastic and unworkable, or does not meet required quality control limits, or has been contaminated by foreign materials.
 4. Remove rejected concrete from the job site.
- C. Placing Concrete in Forms
1. Deposit concrete in horizontal layers not deeper than 24", and avoid inclined construction joints.
 2. Remove temporary spreaders in forms when concrete has reached the elevation of the spreaders.
- D. Placing Concrete Slabs
1. At interior slabs with moisture sensitive toppings, place concrete directly on vapor barrier surface without the use of sand in accordance with ACI 302.R1 flow chart.
 2. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
 3. Bring slab surfaces to the correct level with straightedge and strike off.
 4. Use bullfloats or darbies to smooth the surface, leaving the surface free from bumps and hollows.
 5. Do not sprinkle water on the plastic surface. Do not disturb the slab surface prior to start of finishing operations.
- E. Grouting Column Bases:
1. The grout shall be mixed and placed in strict accordance with manufacturer's instructions.
 2. Care shall be taken in the grouting to ensure that there is full bearing between the base plates and the grout.

3.08 CONSOLIDATION

- A. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators supplemented by hand and spading, rodding, or tamping.
- B. Do not vibrate forms or reinforcement.
- C. Do not use vibrators to transport concrete inside the forms.

3.09 JOINTS

- A. Construction Joints:
1. Do not use horizontal construction joints except as may be shown on the Drawings.
 2. The surfaces of all concrete at all joints shall be thoroughly cleaned and all laitance removed by sandblasting.

3. Concrete surfaces at designated joints shall be roughened to ¼" relief with roto hammer or similar method.
4. Moisten all joints immediately prior to placement of concrete.

B. Expansion Joints:

1. Do not permit reinforcement or other embedded metal items that are being bonded with concrete (except dowels in floors bonded on only one side of the joints) to extend continuously through any expansion joint.
2. Fill expansion joints full depth with expansion joint material approved by the Architect.

3.10 CONCRETE FINISHING

A. Except as may be shown otherwise on the Drawings, provide the following finishes at the indicated locations.

1. Scratch Finish: Apply to monolithic slab surfaces that are to receive concrete floor topping or mortar setting bed.
2. Float Finish: Apply to monolithic slab surfaces that are to receive trowel finish and other finishes specified hereinafter, and to slab surfaces which are to be covered with insulation.
3. Trowel Finish: Apply to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and to slab surfaces that are to be covered with resilient flooring, carpeting, paint, wood, rubber or other thin-film finish coating system. Burnished and over finished surfaces which inhibit bonding of products to concrete shall be sanded or cleaned to expose absorbent concrete by lightly shot blasting or diamond grinding to remove concrete burnished surfaces.

B. Concrete Vapor Sealer: All concrete floors not indicated in the schedule to receive other finish shall receive sealer specified herein.

C. Chemical Hardener: At interior concrete floors to remain exposed, damp cure concrete, do not cure with curing compound. Apply hardener using 3 coats allowing 24 hours between coats. Apply first coat at 1/3 strength, second coat at 1/2 strength and final coat at 2/3 strength. Use manufacturer's recommended application rates. After final coat is dry, remove surplus hardener by scrubbing and mopping with water.

3.11 DEFECTIVE WORK

A. Work considered to be defective may be ordered to be replaced, in which case the Contractor shall remove the defective work at his expense. Work considered to be defective shall include, but not be limited to, the following:

1. Concrete in which defective or inadequate reinforcing steel has been placed.
2. Concrete incorrectly formed, or not conforming to details and dimensions on the drawings or with the intent of these documents or concrete the surfaces of which are out of plumb or level.
3. Concrete below specified strength.

4. Concrete containing wood, cloth or other foreign matter, rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the drawings.

3.12 CORRECTION OF DEFECTIVE WORK

- A. The Contractor shall, at his expense, make all such corrections as directed by the engineer.
- B. Concrete work containing rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the drawings shall be chipped out until all unconsolidated material is removed.

END OF SECTION

**SECTION 03 31 50
GROUT**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall provide grout in accordance with the Contract Documents.
- B. The following types of grout shall be covered in this Section:
 - 1. Cement Grout
 - 2. Packaged Grout
 - A. Nonshrink Grout: This type of grout is to be used wherever grout is illustrated in the Contract Documents unless another type is specifically referenced.
 - B. Epoxy Grout
 - C. Pump and Motor Grout
 - 3. Topping Grout and Concrete Fill

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. The Work of the following Sections apply to the Work of this Section. Other Sections, not referenced below, shall also apply to the extent required for proper performance of this Work.
 - 1. Section 03300 - Cast-in-Place Concrete.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Commercial Standards:
 - 1. CRD-C 621 Corps of Engineers Specification for Non-Shrink Grout
- B. National Sanitation Foundation
 - 1. NSF / ANSI 61: Drinking Water System Components – Health Effects
- C. ASTM Standard in Building Codes:

1. ASTM C 109: Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
2. ASTM C 531: Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing
3. ASTM C 579: Test Methods for Compressive Strength of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing
4. ASTM C 827: Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixture
5. ASTM C 881: Specification for Epoxy-Resin-Base Bonding System for Concrete
6. ASTM C 882: Standard Test for Bond Strength of Epoxy-Resin Systems Used with Concrete
7. ASTM C 884: Standard Test Method for Thermal Compatibility Between Concrete and an Epoxy-Resin Overlay
8. ASTM D 638: Standard Test Methods for Tensile Properties of Plastics
9. ASTM D 696: Test Method for Coefficient of Linear Thermal Expansion of Plastics
10. ASTM D 2471: Standard Test Methods for Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins

1.04 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit certified test results verifying the compressive strength, shrinkage, and expansion requirements indicated herein; and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of nonshrink and epoxy grout used in the Work in accordance with the requirements of the Specification Section for Contractor Submittals.

1.05 QUALITY ASSURANCE

- A. Field Tests:
 1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Engineer to ensure continued compliance with these

- B. Cement grout materials shall be as specified in Section 03300 - Cast-in-Place Concrete.

2.02 PREPACKAGED GROUTS

A. Nonshrink Grout:

1. Nonshrink grout shall be a prepackaged, inorganic, nongas-liberating, nonmetallic, cement-based grout requiring only the addition of water. The manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of nonshrink grout indicated herein shall be that recommended by the manufacturer for the particular application.
2. Class A nonshrink grouts shall have a minimum 28 day compressive strength of 6,000 PSI; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD-C 621.
3. Class B nonshrink grouts shall have a minimum 28-day compressive strength of 5,000 PSI and shall meet the requirements of CRD-C 621.
4. Application:
 - a) Class A nonshrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is indicated; except, for the applications of Class B nonshrink grout and epoxy grout indicated herein. Class A nonshrink grout may be used in place of Class B nonshrink grout for all applications.
 - b) Class B nonshrink grout shall be used for the repair of all holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

B. Epoxy Grout:

1. Epoxy grout shall be a pourable, nonshrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged.

The resin component shall not contain any nonreactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. Epoxy grout shall be BurkEpoxy Anchoring Grout by The Burke Company, Sika or an approved equal.

2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.
3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75°F.
4. The epoxy grout shall develop a compressive strength of 5,000 PSI in 24 hours and 10,000 PSI in 7 days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.
5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a test consisting of filling a 2 inch diameter by 4 inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the void area in the plate measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.
6. The peak exotherm of a 2-inch diameter by 4 inch high cylinder shall not exceed 95°F when tested with 75°F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30×10^{-6} inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.
7. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications in the Contract Documents where grout type is not specifically indicated.
8. For crack repair, the Contractor shall use pressure injection epoxy grout as recommended by the manufacturer and approved by the Engineer.

C Grout for Pumps and Motors

1. Grout for pumps and motors shall be epoxy grouts meeting the following minimum requirements:
 - a) Creep shall be less than 0.005 in/in when tested by ASTM C 881 method. The test shall be at 70°F and 140°F with a load of 400 PSI.
 - b) Linear shrinkage shall be less than 0.080 percent and thermal expansion less than 17×10^{-6} in/in/degree F when tested by ASTM C 531.
 - c) The compressive strength shall be a minimum of 12,000 PSI in 7 days when tested by ASTM C 579 Method 8, modified.
 - d) Bond strength of grout to Portland Cement concrete shall be greater than 2,000 PSI when using ASTM C 882 test method.
 - e) Grout shall pass the thermal compatibility test when overlaid on Portland Cement concrete using test method ASTM C 884.
 - f) Tensile strength and modulus of elasticity shall be determined by ASTM D 638. The tensile strength shall not be less than 1,700 PSI and the modulus of elasticity shall not be less than 1.8×10^6 PSI.
 - g) Gel time and peak exothermic temperature shall be determined by ASTM D 2471. Peak exothermic temperature shall not exceed 110° F when a specimen 6 inches in diameter by 12 inches high is used. Gel time shall be at least 150 minutes.
 - h) The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperatures as high as 150°F, with a load of 2,000 PSI.
2. Primer, if required, shall conform to the written recommendations of the grout manufacturer.
3. Surface preparations shall conform to the written recommendations of the grout manufacturer.
4. Placement and Curing:
 - a) Placement and curing procedures shall be in accordance with the written recommendations of the grout manufacturer.

- b) A grouting performance demonstration/training session shall be conducted by the grout manufacturer's representative prior to foundation and base plate preparation and the first grouting on site. This training session shall demonstrate proper preparation and installation methods and that the grouting material meets the strength requirements.
- 5. Grout shall be Escoweld, Chockfast Red Epoxy Grout as manufactured by Philadelphia Resin Corp.; Five Star DP Epoxy Grout as manufactured by Five Star Products, Inc.; or equal.

2.03 TOPPING GROUT AND CONCRETE FILL

- A. Grout for topping of slabs and concrete fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All materials and procedures specified for normal concrete in Section 03300 - Cast-in-Place Concrete, shall apply except as noted otherwise herein.
- B. Topping grout and concrete fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 3 inches, sitework concrete, as specified in Section 03300 - Cast-in-Place Concrete, may be used when accepted by the Engineer.
- C. Coarse aggregate shall be graded as follows:

U.S. Standard Sieve Size	Percent by Weight Passing
1/2"	100
3/8"	90 - 100
No. 4	20 - 55
No. 8	5 - 30
No. 16	0 - 10
No. 30	0

- D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.
- E. Strength: Minimum compressive strength of topping grout and concrete fill at the end of 28 days shall be 4,000 PSI.

2.04 CURING MATERIALS

- A. Curing materials shall be as specified in Section 03300 - Cast-in-Place Concrete for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.05 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

2.06 NSF / ANSI STANDARD 61

- A. All cementitious material, admixtures, curing compounds, and other industrial produced materials used in concrete, or for curing or repairing of concrete, that can contact potable water or water that will be treated to become potable shall be listed in NSF / ANSI Standard 61.

PART 3 - EXECUTION

3.01 GENERAL

- A. All surface preparation, curing, and protection of cement grout shall be as indicated in Section 03300 - Cast-in-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete.
- B. The manufacturer of Class A nonshrink grout and epoxy grout shall provide on-site technical assistance to Contractor upon request.
- C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Engineer.
- D. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.
- E. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

3.02 GROUTING PROCEDURES

- A. Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be accomplished according to the instructions and recommendations of the manufacturer.
- B. Base Plate Grouting:
 - 1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum 1 inch thickness of grout or a thickness as indicated on the Plans.

2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by the Engineer, alternate grouting methods shall be submitted for acceptance by the Engineer.

C. Topping Grout and Concrete Fill:

1. All mechanical, electrical, and finish Work shall be completed prior to placement of topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.
2. The minimum thickness of grout topping and concrete fill shall be one inch (1") unless otherwise specified by the Plans. Where the finished surface of concrete fill is to form an intersecting angle of less than 45° with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.
3. The base slab shall be thoroughly cleaned and wetted prior to placing topping or concrete fill. No topping or concrete fill shall be placed until the slab is free from standing pools, ponds of water. A thin coat of neat Type II cement grout shall be broomed onto the surface of the slab just before topping or concrete fill placement. The topping or concrete fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted concrete fill for tank and basin bottoms where scraping mechanism are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping or concrete fill have hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used to assist in this operation, but the last pass over the surface shall be by hand-troweling.

During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

3.03 CONSOLIDATION

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

END OF SECTION 03315

SECTION 03 32 00
CONCRETE SEALERS

PART 1 -- GENERAL

1.01 DESCRIPTION

- A. Work included: Seal, harden or color concrete surfaces where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Concrete floor sealer/hardener/densifier shall react with concrete surfaces to produce a dense, hydrophobic, insoluble, moisture barrier to seal out contaminants, while hardening and densifying concrete surface.
- C. Related work:
 - 1. Documents affecting work of this Section included, but are not necessarily limited to, Special Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 03 30 00: Cast-In-Place Concrete
 - 3. Section 03 35 00: Concrete Finishing

1.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use an applicator currently approved in writing by the manufacturer of the specified product.

1.03 SUBSTITUTIONS

Substitutions will not be allowed unless otherwise specified on the plans or approved during the submittal phase by the Construction Manager.

1.04 SUBMITTALS

- A. Submit in accordance with Section for Contractor Submittals of the Specifications.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Sufficient technical data to prove compliance with the specified requirements.
 - 2. Evidence satisfactory to the Architect that the proposed applicator is currently approved by the manufacturer of the specified product.

1.05 JOB CONDITIONS

- A. Ensure concrete has been cured a minimum of 3-days, is free of curing compounds and other sealers, and is free of laitance, grease, oil, and contaminants.
- B. Protect adjacent surfaces/areas from damage due to over-spray

1.06 EXTENDED WARRANTY

Warranty sealed concrete floors to be free of dusting from abrasion for a period of 10-years from date of Substantial Completion. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 -- PRODUCTS

2.01 SEALER

- A. Wherever the Drawing indicates concrete with sealer, the surface shall be treated with ready-to-apply clear sealing compound. Where a sealer is used in conjunction with a hardener with color, use only a product recommended by the manufacturer of the hardener as accepted by the Architect.
- B. Comply with ASTM C 309, Type I, Class B.
- C. Acceptable products:
 - 1. Curcrete Chemical Company Inc. (Springville, Utah) "Ashford Formula".
 - 2. "Industrial Concrete Sealer" by Burke Company, San Mateo, California, (213) 724-6690.
 - 3. "Sealtight Intex" by W.R. Meadows, Inc., Benica, California, (714) 759-5006.
 - 4. "Lithothane Concrete Sealer" by L.M. Scofield Company, Los Angeles, California, (213) 723-5285.

2.02 HARDENER

- A. Wherever the Drawings indicate concrete with hardener, the surface shall be treated with a non-metallic dust-on floor hardener.
- B. Acceptable products:
 - 1. "Non-metallic Floor Hardener" by Burke Company.
 - 2. "Mastercron" by Master Builders, Inc., Anaheim, California, (714) 978-6961.
 - 3. "Lithochrome" by L.M. Scofield.

2.03 HARDENER WITH COLORS

- A. Wherever the Drawings indicate colored concrete floor hardener, the surface shall be treated with a non-metallic dust-on hardener in colors selected by the Architect.
- B. Acceptable products:
 - 1. "Lithochrome Color Hardener" by L.M. Scofield Company.
 - 2. "Colorcron" by Master Builders, Inc.

PART 3 -- EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which the work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Beginning of installation means acceptance of conditions.

3.02 APPLICATION OF SEALER

A. Preparation:

- 1. On freshly finished concrete surfaces, no additional surface preparation is required.
- 2. On areas where forms are recently removed, remove all form oil and breaking compound residue to assure penetration of the product in to the pores of the material to be treated.
- 3. On existing concrete, vertical surfaces, and masonry surfaces:
 - a. Sweep all areas to be treated, using a fine bristle broom, or hose off with water and let dry to remove all surface dust and dirt.
 - b. Free the surface from all contaminants which would inhibit penetration of the product into the pores of the material to be treated.
 - c. Remove all curing, sealing, and coating agents by use of chemical or mechanical means as necessary.
 - d. If acid is used to remove surface coatings, flush the surface with water sufficiently to remove all acid and acid residue.
- 4. When applying near windows, mask the glass.
- 5. Avoid contact with plant life, glass, aluminum, and other finished surfaces. Where contact occurs, immediately wipe a damp cloth or flush with water.
- 6. Avoid contact with asphaltic concrete.

B. Application:

- 1. On freshly finished surfaces, spray the product with a low pressure sprayer immediately following the finishing operation.
 - a. To assure proper curing, apply the product to the entire surface as soon as the surface is firm enough to walk on, and before checking and temperature cracking begins.
 - b. Keep the entire surface wet for 30 minutes by brooming excess product on to the dry spots, or by re-spraying the dry spots immediately.

- c. As the product begins to dry into the surface and becomes slippery underfoot, lightly sprinkle the surface with water to aid penetration and to bring alkali to the surface.
 - d. As the product again begins to dry into the surface and become slippery underfoot, flush the surface with water and squeegee the surface totally dry, removing all excess product and alkali or other impurities brought to the surface.
- 2. On broom-finished surfaces, no flushing is required, but squeegee or broom the excess product from surface after 30 to 40 minutes.
- 3. On cured concrete surfaces, saturate the surface with the specified product.
 - a. If dry spots appear, broom excess material onto the dry spots or re-spray them immediately.
 - b. Keep the entire surface wet with the product for 30 minutes.
 - c. If, after 30 to 40 minutes, the majority of the product has not been absorbed into the surface, broom or squeegee the excess product from low spots and puddles so it will be absorbed into the surface, or remove such excess product from the surface.
 - d. If, after 30 to 40 minutes, the majority of the product is still on the surface, wait until the surface becomes slippery underfoot and then flush the entire surface with clear water and squeegee completely dry. If no water is available, squeegee the excess product from the surface after 30 minutes so that the surface is completely dry.

3.03 APPLICATION OF HARDENER

Apply the hardener after the surface of the concrete has reached the stage where no excess moisture shows, but while still plastic.

- 1. Hardener shall be applied at the rate of 40 pounds per 100 square feet of surface for the initial application.
- 2. Hardener shall be evenly distributed and thoroughly floated into the surface mortar with a wood float. 20 pounds of additional hardener shall be applied over each uniform color and texture.
- 3. All hardener and/or colored concrete floors shall be cured and protected with concrete curing paper or plastic until just prior to final cleaning.
- 4. Before applying curing paper or plastic, interior floors treated with colored hardener shall be given a heavy protective coat of colored wax left unpolished, and then immediately covered with the paper. If wax is not applied within two (2) hours after final troweling, the concrete shall be sprayed with a fine water mist and kept continuously moist until wax is applied, unless spraying is not recommended by the manufacturer of the hardener.

5. Cleaning and finishing: After all other work including plastering and painting has been completed, the curing paper shall be removed and waxed floors cleaned of protective wax coating. Clean all floors to remove dirt, stains or blemishes, and repair and restore damaged floors to their original condition. The hardener manufacturer's recommendations, directions, and recommended materials and methods shall be used for the protective wax coating, cleaning and finishing work.

END OF SECTION

**SECTION 03 35 00
CONCRETE FINISHING**

PART 1 -- GENERAL

1.01 DESCRIPTION

Work included: Provide finishes on cast-in-place concrete as called for on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Except as may be modified herein or otherwise directed by the Architect, comply with ACI 301, "Specifications for Structural Concrete for Buildings".

1.03 SUBSTITUTIONS

Substitutions will not be allowed unless otherwise specified on the plans or approved during the submittal phase by the Construction Manager.

1.04 SUBMITTALS

- A. Submit in accordance with Section for Contractor Submittals of the Specifications.
- B. Product data, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
 - 3. Manufacturer's recommended installation procedures which, when accepted by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.05 PRODUCT HANDLING

Comply with pertinent provisions of Division 1.

1.06 CLOSE-OUT: also comply with the requirements of Section 01700 – Project Closeout.

- A. Reports:
None required.
- B. As-Builts:
Not required
- C. Operation and Maintenance Data:
None required.
- D. Extra Materials:

None required.

E. Extended Warranty:

Comply with the requirements of General Condition Article 6 and Section 01700.

PART 2 -- PRODUCTS

2.01 MATERIALS

A. General:

1. Carefully study the Drawings and these Specifications, and determine the location, extent, and type of required concrete finishes.
2. As required for the Work, provide the following materials, or equals accepted in advance by the Architect.

B. Liquid bonding agent: "Weld-Crete," manufactured by the Larsen Products Corporation.

C. Curing and protection paper:

1. Comply with ASTM C171, Type 1, regular.
2. Accepted products:
 - a) "Sisalkraft, Seekure 896";
 - b) Equal non-staining products faced with polyethylene film.

D. Slip-resistant abrasive aggregate:

1. Provide aluminum oxide grains, uniformly graded, screen size 12-13, 14-36 or 16-30.
2. Acceptable product:
 - a) Emerchrome Floor Hardener by L.M. Scofield Company.
 - b) Frictex H by Sonneborn.
 - c) or approved equal.

2.02 OTHER MATERIALS

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

PART 3 -- EXECUTION

3.01 EXAMINATION

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

- B. Correct conditions detrimental to timely and proper completion of the Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Beginning of installation means acceptance of conditions.

3.02 FINISHING OF FORMED SURFACES

- A. General:
 - 1. After removal of forms, give exposed concrete surfaces the finish specified below.
 - 2. Revise the finish as needed to secure the acceptance of the Architect.
- B. Rubbed finish:
 - 1. Do not start cleaning operations until all contiguous surfaces to be cleaned are completed and accessible.
 - 2. Do not permit cleaning as the work progresses.
 - 3. Mix one part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint.
 - 4. Substitute white portland cement for part of the gray portland cement as required to produce a color matching the color of surrounding concrete, as determined by a trial patch.
 - 5. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout, and apply the grout uniformly with brushes or spray gun.
 - 6. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.
 - 7. While the grout is still plastic, remove all excess grout by working the surfaces with a rubber float, sack, or other means.
 - 8. After the surface whites from drying (above 30 minutes at normal temperatures), rub vigorously with clean burlap.
 - 9. Keep the surface damp for at least 36 hours after final rubbing.

3.03 FINISHING SLABS

- A. Definition of finishing tolerances:
 - 1. "Class A": True plane within 1/8" in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.
 - 2. "Class B": True plane within 1/4" in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.
- B. Scratched finish: For surfaces scheduled to receive bond-applied cementitious applications.

1. After the concrete has been placed, consolidated, struck off, and leveled to a Class B tolerance, roughen the surface with stiff brushes or rakes before the final set.
- C. Floated finish: For surfaces intended to receive roofing.
1. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further until ready for floating.
 2. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
 3. During or after the first floating, check the planeness of the surface with a ten foot straightedge applied at not less than two different angles.
 4. Cut down high spots and fill low spots, and produce a surface with a Class B tolerance throughout.
 5. Refloat the slab immediately to a uniform sandy texture.
- D. Troweled finish:
1. Provide a floated finish as described above, followed by a power troweling and then a hand troweling which is relatively free from defects, but which still may show some trowel marks.
 - a. Monolithic Trowel Finish: For all floor surfaces not otherwise specified. Steel trowel and retrowel to smooth surface. After concrete has set enough to ring true, retrowel to a burnished impervious finish, free of trowel marks or other blemishes.
 - b. Steel Float Finish: for all slabs to receive resilient tile, waterproof membrane, or carpeting. Same as monolithic finish except omit burnish retroweling.
 - c. Fine Swirl Finish (when shown on the Drawings): Prepare same as steel float finish. When ready, perform such finishing operations as necessary to produce Architect-selected fine textured, non-slip finish. Construct sample panel for Architect's acceptance prior to placement. Sample panel shall consist of tooled edges and have a tooled joint within field of panel.
 2. Provide a finished surface essentially free from trowel marks, uniform in texture and appearance, and in a plane of Class A tolerance.
- E. Broom finish: For slabs to receive thin set tiles, apply steel float finish followed by very fine broom finish. For surfaces to receive mortar setting beds and for exterior concrete driveway ramps, curbs and gutters, spandrels, etc.
1. Provide a finished surface uniform in texture and appearance, and in a plane of Class A tolerance. Roughen surface with coarse broom.
- F. Rock Salt finish: Exterior walkways and pavings except where non-slip finish is specified.

1. Provide a floated finish as described above.
 2. While the surface is still plastic, broadcast rock salt into the surface and embed uniformly into the surface by light tamping.
 3. Float the surface until it has been brought to a true plane with Class B tolerance.
 4. After the concrete has completely set, flood the surface with water to dissolve the rock salt, using a fine bristle brush as necessary to remove the salt.
 5. Provide a sample panel at the site of the proposed finish and receive the acceptance of the Architect of that finish prior to placing of the paving.
- G. Non-slip finish: For exterior platforms, steps, and landings; and Interior and exterior pedestrian ramps.
1. Provide a floated finish as described above.
 2. While the surface is still plastic, broadcast abrasive aggregate as specified in Paragraph 2.01.F above and work into the surface according to the manufacturer's recommendations.
 3. Complete finishing surface as described above for a troweled finish, and as recommended by the aggregate manufacturer.

3.04 CURING AND PROTECTION

- A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures, and mechanical injury.
- B. Preservation of moisture:
1. Unless otherwise directed by the Architect, apply one of the following procedures to concrete not in contact with forms, immediately after completion of placement and finishing.
 - a. Ponding or continuous sprinkling;
 - b. Application of absorptive mats or fabric kept continuously wet;
 - c. Application of sand kept continuously wet;
 - d. Continuous application of steam (not exceeding 150° F) or mist spray;
 - e. Application of waterproof sheet materials specified in Part 2 of this Section;
 - f. Application of other moisture-retaining covering as accepted by the Architect.
 - g. Where forms are exposed to the sun, minimize moisture loss by keeping the forms wet until they can be removed safely.
 2. Cure concrete by preserving moisture as specified above for at least ten days.
- C. Temperature, wind, and humidity:

1. Cold weather:
 - a) When the mean daily temperature outdoors is less than 40° F, maintain the temperature of the concrete between 50° F and 70° F for the required curing period.
 - b) When necessary, provide proper and adequate heating system capable of maintaining the required heat without injury due to concentration of heat.
 - c) Do not use combustion heaters during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
 2. Hot weather: When necessary, provide wind breaks, fog spraying, shading, sprinkling, ponding, or wet covering with a light-colored material, applying as quickly as concrete hardening and finishing operations will allow.
 3. Rate of temperature change: Keep the temperature of the air immediately adjacent to the concrete during and immediately following the curing period as uniform as possible and not exceeding a change of 5° F in any one hour period, or 50° F in any 24 hour period.
- D. Protection from mechanical injury:
- During the curing period, protect the concrete from damaging mechanical disturbances such as heavy shock, load stresses, and excessive vibration.
1. Protect finished concrete surfaces from damage from construction equipment, materials, and methods, by application of curing procedures, and by rain and running water.
 2. Do not load self-supporting structures in such a way as to over stress the concrete.

*****END OF SECTION*****

**SECTION 03 40 00
PRECAST CONCRETE**

PART 1 -- GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the precast concrete work in accordance with the Contract Documents.
- B. This Section covers the design, fabrication, delivery and installation of all plant precast concrete units, including connections, complete, in place, as shown and specified.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03 31 50 - Grout
- B. Section 07 90 00 – Sealants and Caulking

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Comply with reference standards of the General Requirements.
- B. NSF / ANSI 61: Drinking Water System Components – Health Effects
- C. Comply with the current provisions of the following Codes and Standards, as applicable:
 - 1. Commercial Standards:

ACI 301	Specifications for Structural Concrete
ACI 304	Guide for Measuring, Mixing, Transporting and Placing Concrete
ACI 311	Guide for Concrete Plant Inspection and Testing of Ready-Mixed Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete

ACI 347	Guide to Formwork for Concrete
AWS A5.4	Welding Rods and Electrodes
AWS D1.1	Welding and Cutting
AWS D1.4	Structural Welding Code – Reinforcing Steel
ASTM A 184	Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement
ASTM A 193	Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194	Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 351	Specification for Steel Castings, Austenitic, for High-Temperature Service
ASTM A 497	Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A 580	Specification for Stainless and Heat-Resisting Steel Wire
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 666	Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications
ASTM A 775	Specifications for Epoxy-Coated Reinforcing Steel Bars
ASTM C 33	Specification for Concrete Aggregates
ASTM C 67	Method for Sampling and Testing Brick and Structural Clay Tile

ASTM C 127	Test Method for Specific Gravity and Absorption of Coarse Aggregate
ASTM C 128	Test Method for Specific Gravity and Absorption of Fine Aggregate
ASTM C 150	Specification for Portland Cement
ASTM C 173	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 204	Test Method for Fineness of Portland Cement by Air Permeability Apparatus
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 311	Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 494	Test Method for Shear Fatigue of Sandwich Core Materials
ASTM D 2240	Test Method for Rubber Property -- Durometer Hardness
AWS B2.1	Specification for Welding Procedure and Performance Qualification
PCI MNL-116	Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
PCI MNL-117	Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products
PCI MNL-121	Manual for Structural Design of Architectural Precast Concrete

2. Government Standards:
CSS Caltrans Standard Specifications.

1.04 CONTRACTOR SUBMITTALS

- A. Submittals shall be made in accordance with the General Requirements.
- B. Shop Drawings:
 1. Shop drawings shall provide details in accordance with ACI 315 and ACI 318 including installation details.
 2. Shop drawings, including design computations, shall be stamped and signed by a Civil or Structural Engineer registered in the State of California and shall be approved by the Engineer.
 3. Shop drawings shall indicate precast unit identification marks, location of units in the Work, elevations, fabrication details, welding details, reinforcement, connections, dimensions, interface with adjacent members, and special handling instructions in sufficient detail to cover manufacture, handling, and erection. Shop drawings shall include erection drawings. Shop drawings shall also include design computations for above-mentioned drawings.
 4. Shop drawings shall be divided into complete separate submittals for each structure. Each complete submittal shall consist of a panel schedule and shop drawings.
 - a. Panel Schedule: Showing all exterior elevations of the structure, including all precast concrete enclosure faces exposed to view, in its associated shop drawing submittal. Elevations at a minimum scale of $1/8" = 1'-0"$ shall be drawn, identifying the type and location of each panel by a number which corresponds to the panel number appearing on an associated shop drawing; this same number shall be permanently marked on the back of each panel as they are fabricated.
 - b. Shop Drawings: Showing all elevations, dimensions, horizontal and vertical sections, openings, inserts, reinforcing, anchorage devices, pick-up points, details, design computations, and other requirements for each different type of panel to be incorporated into the portion of the project covered by the submittal. Drawings shall be 24 inches x 36 inches maximum.

- c. For bridge structures, shop drawings for precast concrete piles shall conform to Section 49-3 of the CSS.

C. Small Samples:

1. Unless otherwise specified on the contract documents, two 72 inch by 72 inch samples of precast concrete unit finish shall be submitted, as required for the project. Each sample shall show matrix color, surface color, surface texture, and panel back finish.
2. When so requested by the Engineer, submit samples of cast-in gaskets, anchorages and other attachments and accessories.
3. The face of each sample shall contain at least two areas of approved size and shape which have been chipped out and then patched and repaired and one form joint; the color, texture and appearance of patched areas and form joint shall match that of adjacent surface.
4. Samples will be inspected for color and texture match to the samples selected by the Engineer, uniformity of color and texture throughout the panel and acceptability of patching and joint treatment. Exposed face of samples shall be tested for efflorescence in accordance with ASTM C 67; rating shall not be more than "slightly effloresced."
5. If the Engineer rules a sample, or samples, to be unacceptable, the Contractor shall fabricate and resubmit additional samples at no additional cost to the Owner.
6. When approved, one sample will be kept at the Engineer's office and the other shall be picked up by the Contractor and returned to the manufacturing plant. These sample panels will be used as a comparison to judge acceptability of the full-size panel samples and, where necessary, the production precast units.

D. Full-Size Panel Samples at Manufacturing Plant:

1. After the small samples and shop drawings have been approved, and prior to fabricating panels for the project, a full-size panel of specified color and each finish shall be produced and erected at the manufacturing plant for inspection and approval by the Engineer.
2. The full-size panels shall be fabricated utilizing tools, forms, materials and techniques proposed and the dimensions, profile cross section, color and texture required for the project. Panels will be inspected for color and texture to match approved samples, uniformity of color and texture

throughout the panel, accuracy and sharpness of shape, acceptability of patched and repaired areas, and form joint treatment.

3. If the Engineer rules a sample to be unacceptable, the Contractor shall fabricate additional revised panel(s) at no additional cost to the Owner. When approved, panels shall be preserved, remain at the plant, and become the job standard against which all panels will be compared as they come off the production line.
- E. Full-Size Panel Samples at Project Site: From the first loads of acceptable panels for the Project, the Engineer will select one panel of each texture which is scheduled to be erected in a prominent location. If the Engineer chooses, panels may be selected from a later load. The selected panel(s) together with the Small Sample from Section 1.4.C kept at the Engineer's office, will become the Site standard against which all panels will be compared.
- F. Mix Proportions: Prior to commencing operations, including fabrications of the precast concrete for any mock-up, a statement shall be submitted giving the nominal maximum aggregate size and proportions of all ingredients that will be used in the manufacture of concrete. The statement shall include test results from an approved testing laboratory, with certification stamp and signature by a Civil or Structural Engineer registered in the State of California. No substitutions shall be made in materials used in the concrete mix without approval and additional tests to verify that the concrete properties are satisfactory. A copy shall be submitted of concrete mix with each set of samples.
- G. Test Reports: Tests for compressive strength of concrete shall be performed by an approved independent commercial testing laboratory at no cost to the Owner. Copies of test reports including all test data and all test results shall be submitted for review and approval of the Engineer.
- H. Certificates of Compliance: Certificates of compliance shall be submitted attesting that materials and products meet or exceed specified requirements.
- I. Manufacturer's Qualifications: Prior to commencing operations, a statement shall be submitted giving the qualifications of the precast concrete Manufacturer, and evidence that the Manufacturer and plant are PCI certified.

1.05 QUALITY ASSURANCE

- A. General Requirements: Design precast members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete units, registered in the State of California and conforming to requirements of PCI MNL-121 and to ACI 318.
1. Precast Manufacturer and erectors shall be qualified in accordance with PCI MNL-117 and MNL-116.
 2. Welding shall be in accordance with AWS D 1.1, AWS D 12.1, AWS B 2.1, and AWS A 5.4.
 3. Manufacture, Transportation and Installation: The Manufacturer shall specialize in providing precast products and services normally associated with precast concrete construction with high quality architectural finishes similar to that indicated on the Plans, using procedures complying with PCI MNL-116 and MNL-117, and PCI plant certified for at least 5 years.
 4. Use adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work of this Section.

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 05 50 00 - Metal Fabrications: fabricated steel items.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- D. Section 07 84 00 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.
- E. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
 - 1. Use 2014 as indicated in 2016 CBC Ch. 35 Referenced Standards.
- B. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- C. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.
- D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
 - 1. Use 2004 as indicated in 2016 CBC Ch. 35 Referenced Standards.
- E. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
 - 1. Use 2012 as indicated in 2016 CBC Ch. 35 Referenced Standards.
- F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- H. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- I. DSA, Interpretation of Regulations Document IR 21-2.13 - Concrete Masonry High Lift Grouting Method; 3/03/16.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.

- B. Product Data: Provide data for masonry units and masonry accessories.
- C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- D. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.
- E. Installer's Qualification Statement.
- F. Maintenance Materials: Furnish the following for District's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
 - 1. Maintain one copy of each document on project site.
- B. Regulatory Requirements: Except as modified by the requirements specified herein or the details indicated, reinforced concrete unit masonry construction shall conform to the California Building Code (CBC), Title 24, Part 2, Chapter 21A - Masonry.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- E. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
 - 1. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Acceptable Manufacturers:
 - 1. Angeles Block Co., Inc.: www.angelusblock.com.
 - 2. Orco Block Co.: www.orco.com.
 - 3. RCP Block and Brick: www.rcpblock.com.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 x 8 inches or as indicated and nominal depths as indicated on the Drawings for specific locations.
2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
3. Load-Bearing Units: ASTM C90, medium weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
 - c. Pattern: As indicated on Drawings.
 - 1) CMU-1: Precision; Color: As indicated on Drawings
 - d. Non-Loadbearing Units: ASTM C129.
 - 1) Hollow block, as indicated.
 - 2) Medium weight.
 - e. Solid Cap Unit: Nominal unit size, texture and color to match adjacent wall, unless specified otherwise.

2.02 MORTAR AND GROUT MATERIALS

- A. All materials to conform to CBC, Section 2103A.2 and 2103A.3.
- B. Masonry Cement: ASTM C91/C91M, Type S.
- C. Portland Cement: ASTM C150/C150M, Type I.
 1. Not more than 0.60 percent alkali.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Mortar Aggregate: ASTM C 144, except for joints less than 1/4-inch use aggregate graded with 100 percent passing the No. 16 sieve.
- F. Grout Aggregate: ASTM C404.
- G. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: Type specified in Section 03 20 00; size as indicated on drawings; uncoated finish.

2.04 ACCESSORIES

- A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, fused joints.
 1. Manufacturers:
 - a. Blok-Lok Limited: www.blok-lok.com/#sle.
 - b. Dur-O-Wal: www.dur-o-wal.com.
 - c. Hohmann & Barnard, Inc: www.h-b.com.
 - d. WIRE-BOND: www.wirebond.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self expanding; 3/8 inch wide by maximum lengths available.

1. Manufacturers:
 - a. Hohmann & Barnard, Inc: www.h-b.com.
 - b. WIRE-BOND: www.wirebond.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
 1. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2-cup dry measure) and laundry detergent (1/2-cup dry measure) dissolved in one gallon of water.
 2. Basis of Design Product: Enviro Klean as manufactured by ProSoCo, Inc., www.prosoco.com, or equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Comply with CBC Section 2104A in addition to referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.
- C. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.
- D. Cut or trim interior of face shells or cross webs of masonry units, where necessary, to provide a minimum clearance of 1/2 inch or one bar diameter, whichever is greater, to reinforcing bars.
- E. Protection of Unit Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each workday. Cover partially completed unit masonry when construction is not in progress.
 1. Extend cover a minimum of 24-inches down both sides and hold cover securely in place.
- F. Stain Prevention: Prevent grout, mortar, and soil from staining the face of unit masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.
- G. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond; do not tooth. Clean exposed surfaces of set masonry, and remove loose masonry units and mortar prior to laying fresh masonry.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
 - 1. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 2. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- C. Lay hollow masonry units with face shell bedding on head and bed joints.
- D. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- E. Remove excess mortar and mortar smears as work progresses.
- F. Interlock intersections and external corners, except for units laid in stack bond.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools (motor-driven saws) to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Use full-size units without cutting where possible.
- I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.
- L. Provide smooth finished (e.g. precision) masonry units behind light fixtures, accessories or other flush fitting wall mounted equipment.
 - 1. Place the mounting of such equipment anchors on the center one-half of the closest block.

3.06 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

- A. Place continuous joint reinforcement in first and second joint below top of walls.

- B. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- C. Lap joint reinforcement ends as indicated on Drawings, minimum 6 inches.
- D. Reinforce joint corners and intersections with strap anchors 16 inches on center.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 16 inches horizontally and 16 inches vertically.

3.07 CONTROL AND EXPANSION JOINTS

- A. Control Joints: As indicated on Drawings.
- B. Control Joints: Locate control joints maximum 24 feet on center or as indicated. If not shown, provide submittal to Architect with proposed locations for approval.
- C. Expansion Joints: As indicated on Drawings.
- D. Do not continue horizontal joint reinforcement through control or expansion joints.
- E. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- F. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- G. Comply with Section 07 92 00 for sealant performance.
- H. Form expansion joint as detailed on drawings.

3.08 BUILT-IN WORK

- A. As work progresses, install built-in fabricated metal frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

3.09 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Verify tolerances prior to placing next course. If the unit placed does not meet the tolerances listed below, it shall be removed and reinstalled to meet specified tolerances at no additional cost to District.
- C. Maximum Variation from Alignment of Columns: 1/4 inch.
- D. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- E. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- F. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- G. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

- H. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- I. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.10 CUTTING AND FITTING

- A. Cut and fit for chases and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.11 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Inspection and Core Tests shall be per DSA IR 21-2.13 and 2105A.4.

3.12 REPAIRING AND POINTING

- A. Repairing: Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

3.13 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.
- E. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 - 4. Clean concrete unit masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.

3.14 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 04 22 00

CONCRETE MASONRY UNITS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units (CMU).
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Control joint materials.
 - 5. Masonry joint reinforcement.
 - 6. Ties and anchors.
 - 7. Embedded flashing.
 - 8. Miscellaneous masonry accessories.

1.02 SUBMITTALS

- A. Certificates of compliance with respective ASTM standards shall be submitted on all products specified herein.
 - 1. Concrete masonry units.
 - 2. Spec Mix preblended mortar: Include test report or batch data for verification of proportions of materials.
 - 3. Grout: Include mix design for verification of proportions of materials.
 - 4. Steel reinforcing bars.
 - 5. Preformed control joint gaskets.
- B. Samples for Verification: For each type and color of the following:
 - 1. Exposed concrete masonry units.
 - 2. Mortar, for color selection or confirmation.

1.03 QUALITY ASSURANCE

- A. Preconstruction Testing.
 - 1. Owner will select a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner.
 - 2. The compressive strength of masonry shall be determined based on strength of the unit and type of mortar specified (Unit Strength Method) per ACI 530.1/ASCE 6/TMS 602 Table 2).
 - a. Concrete Masonry Units: Test per ASTM C 140.
 - b. Grout: Test per ASTM C 1019.

3. Mortar and grout tests: At beginning of work, sample mortar and grout on three successive working days per CBC Section 2105A.3.
- B. Sample Panels: Construct an approximate long by panel for representation of completed masonry, joint tooling, design details, and workmanship. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. All materials of this section shall be protected to maintain quality and physical requirements.
- B. All masonry units shall be stored on the jobsite so that they are protected from rain, stored off-ground and kept clean from contamination. Prevent units from being otherwise wetted.
- C. Store Spec Mix preblended mortar mix in manufacturer's original, unopened, undamaged containers with identification labels intact, covered and protected from weather, or in a Spec Mix dispensing silo.

1.05 FIELD CONDITIONS

- A. Securely cover tops of all unsheltered walls and partially completed walls when work is not in progress.
- B. Cold-weather and hot-weather masonry construction is addressed in IBC Sections 2104.3 and 2104.4, respectively. Include and modify below as necessary.
- C. Cold-weather procedures when ambient temperature falls below 40°F (4°C) or the temperature of masonry units is below 40°F (4°C):
 1. Wet or frozen units shall not be laid.
 2. Implement cold weather construction procedures in accordance with IBC Section 2104.3.
- D. Hot-weather procedures when ambient temperature exceeds 100°F (38°C), or exceeds 90°F(32°C) with a wind velocity greater than 8 mph:
 1. Implement hot weather construction procedures in accordance with IBC Section 2104.4.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Concrete masonry units.
 1. Angelus Block Co., Inc.
 - a. Sun Valley, CA (818) 767-8576
 - b. Orange, CA (714) 637-8594
 - c. Fontana, CA (909) 350-0244
 - d. Gardena, CA (310) 323-8841
 - e. Oxnard, CA (805) 485-1137
 - f. Indio, CA (760) 347-3245

- B. Preblended mortar.
 - 1. Spec Mix Preblended Mortar Mix, by E-Z Mix, Inc.

2.02 MASONRY PERFORMANCE REQUIREMENTS

- A. Provide materials to achieve the net compressive strength of concrete unit masonry equal to or greater than 2,000 psi f'_m .
- B. Provide materials to achieve the net compressive strength of concrete unit masonry equal to or greater than the f'_m as indicated.

2.03 CONCRETE MASONRY UNITS

- A. Concrete Masonry Units: ASTM C 90, Net area compressive strength: 2,000 psi.
 - 1. Weight Classification: Medium weight unless otherwise indicated.
 - 2. Color(s) and texture(s):
 - a. Grey

2.04 MORTAR AND GROUT MATERIALS

- A. Spec Mix Masonry Mortar preblended factory mix: ASTM C 270, proportions.
 - 1. Portland cement: ASTM C 150
 - 2. Hydrated lime: ASTM C 207
 - 3. Aggregate for mortar: ASTM C 144.
 - 4. 28-day strength: 2,000 psi minimum.
- B. Grout:
 - 1. Portland cement: ASTM C 150
 - 2. Aggregate: ASTM C 404.
 - 3. Fly ash: ASTM C 618.
 - 4. 28-day strength: 2,000 psi minimum.
- C. Water: Potable.
- D. Admixtures:
 - 1. The use of admixtures shall not be permitted except as specified herein, or as approved by the Architect or Engineer of Record and the Building Official.
 - 2. PRE-MIX Products Grout Additive manufactured by E-Z Mix, Inc. Use per manufacturer's specifications.

2.05 REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A 615, Grade 60.
- B. Masonry Joint Reinforcement: ASTM A 951.
 - 1. Masonry joint reinforcement used in exterior walls shall be hot-dipped galvanized.

2.06 TIES AND ANCHORS

- A. Metal ties and anchors shall meet the requirements of CBC Section 2103.13.

2.07 MISCELLANEOUS MASONRY ACCESSORIES

- A. PVC Preformed Control-Joint Gaskets: per ASTM D 2287, Type PVC.
- B. Rubber Preformed Control-Joint Gaskets: per ASTM D 2000, Designation M2AA-805.

2.08 MORTAR AND GROUT MIXES

- A. Type S Spec Mix Preblended, Dry Mortar Mix.
 - 1. Complies with ASTM C 270 Proportion Specification.
 - 2. Natural gray color.
- B. Grout for Unit Masonry: per ASTM C 476.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to the start of masonry installation, verify all conditions pertinent to the performance of work in this Section are acceptable.
 - 1. Foundation shall be level and at correct grade such that the initial bed joint shall not be less than 1/4 inch nor more than 3/4 inch.
 - 2. Verify that reinforcing dowels are properly placed.
- B. Masonry work shall not proceed until unsatisfactory conditions have been corrected or cleared by the governing authority.

3.02 INSTALLATION

- A. Cut units as required to fit; use motor-driven masonry saw. Install cut units with cut surfaces edges concealed as much as possible.
- B. Lay dry units only, unless otherwise approved.
- C. Select and arrange units for exposed masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- D. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602.

3.03 LAYING MASONRY WALLS

- A. All masonry shall be laid true, level, plumb, and in accordance with the drawings.
- B. Masonry shall be laid in running bond unless otherwise indicated.
- C. Exposed masonry shall be laid in unless otherwise indicated.
- D. Concealed masonry with shall be laid in running bond unless otherwise indicated.
- E. Install built-in items specified in this and other Sections as work progresses. Solid grout all spaces around built-in items unless otherwise noted on the drawings.

3.04 MORTAR BEDDING AND JOINTING

- A. Lay hollow units with head and bed joints filled with mortar for the thickness of the face shell.

- B. Lay solid units with full head and bed joints. Do not fill head joints by slushing with mortar. Bed joints shall not be furrowed deep enough to produce voids.
- C. All mortar joints on exposed walls shall be concave, unless otherwise indicated, and struck to produce a dense, slightly concave surface well bonded to the surface of the masonry unit.
- D. Cut joints flush for masonry walls to receive plaster, unless otherwise indicated.
- E. Thickness of bed joints shall not exceed 5/8 inch.

3.05 MASONRY JOINT REINFORCEMENT

- A. Embed joint reinforcement with minimum 5/8 inch cover to exposed face, and 1/2 inch elsewhere.

3.06 CONTROL AND EXPANSION JOINTS

- A. Construct control joints as detailed in the drawings as masonry progresses.
 - 1. Install preformed control-joint gaskets designed to fit standard sash block.

3.07 INSTALLATION OF REINFORCING STEEL

- A. Place reinforcement as detailed on the drawings.
 - 1. Maintain clear distances between reinforcement and masonry, and maintain placement tolerances in compliance with requirements in ACI 530.1/ASCE 6/TMS 602.

3.08 GROUTING: Either High Lift or low lift systems may be used.

- A. Low Lift System:
 - 1. Comply with CBC, Sec. 2104A.1.3.1.1.1.1.
 - 2. This system includes placing reinforcing steel before or during construction of wall, and pouring grout in lifts not exceeding 4 feet, unless cleanouts are provided as specified under High Lift Grout System.
 - 3. Keep mortar out of grout spaces.
 - 4. Place reinforcing steel accurately according to drawings and notes thereon. Erect vertical reinforcing before laying masonry and brace firmly in position. Use frames or other suitable devices to prevent movement or jarring while placing masonry or grout. Place horizontal steel as construction progresses. Lap steel at least 48 bar diameter. Extend steel through points of stoppage to provide required lap. Horizontal steel may be wired temporarily above required position and tagged to indicate its location and vertically marked indicators maintained showing required location of horizontal bars.
 - 5. After completion of grouting if doubt exists whether or not steel has been properly placed, use drill to locate steel, or open masonry as required by Architect. Make repairs as directed.
 - 6. Install anchor bolts with the tail of bolt hooked over a continuous horizontal bar or an added #4 horizontal bar. Dry pack around void where anchor bolt penetrates masonry face shell.

7. Fill masonry cores with grout and immediately consolidate each cell with a mechanical vibrator having 3/4 inch head and operating at 5000 RPM submerged.
 8. Pour grout to 1½ inches below top of masonry unit except at finish course. Immediately remove grout or mortar on exposed faces.
 9. Form construction joints by stopping grout 1½ inches below top of wall. If construction is to be stopped for more than 1 hour, form construction joint with block top surface free of mortar or grout.
 10. At jambs use temporary wood dams where necessary to contain mortar and grout.
- B. High Lift Grout System: Construct high lift concrete block masonry construction to CBC, Sec. 2104A.1.3.1.1.1.2. and DSA IR 21-2.13, and with the following requirements.
1. High lift grouting shall not be used on walls that do not conform with DSA IR 21-2.13. The Walls Shown on these Details shall not be grouted by high lift grouting:
 - a. Detail 8 on Sheet S402.
 2. Provide open end concrete masonry units.
 3. Where horizontal reinforcing occurs, provide bond beam units with 3-inch high by 3-inch wide vertical openings at all cross webs.
 4. Provide cleanout openings for cells at the bottom of each pour. make openings before the start of laying, of sufficient size and location to allow flushing away mortar droppings and debris. Cleanout openings may be cut in the blocks or formed in the foundation.
 5. After the laying of masonry units is completed, the cells cleaned, the reinforcing positioned, and inspection completed, close the cleanouts by inserting face shells of masonry units or covering the opening with forms. Face shell plugs shall have a 2 day minimum curing time and shall be adequately braced to resist the pressure of the fluid grout.
 6. Accurately place reinforcing steel inserts and bolts in strict accordance with the Contract Drawings. Hold both horizontal and vertical reinforcing in position by wire ties or spacing devices near ends and at intervals not exceeding 160 diameters of the reinforcement.
 7. Place the horizontal reinforcing as the construction progresses. Thread the vertical reinforcing into position after the completion of laying if adequate positioning devices and clearances are provided to permit such placement. Otherwise, erect vertical reinforcement ahead of masonry work.
 8. Use bond beam units to facilitate the horizontal flow of grout and at all horizontal bars to provide a minimum opening at cross webs 1½ inches high for the width of the cell.
 9. Fill head and be joints solidly with mortar. Take care in placing the mortar to keep a minimum of droppings from falling into the block cells.
 10. When adequate cross webs between face shells are not provided, install ties of heavy gage wire (minimum of #9 galvanized) embedded in the horizontal mortar joints across continuous vertical joints or between face shells to prevent "blowouts" from hydrostatic pressure of the fluid grout. External ties or braces may also be used for this purpose.

11. Adequately brace undergrouted walls against wind and other lateral forces during construction.
12. Remove mortar droppings and overhangs from the foundation or bearing surface, cell walls, and reinforcing. Acceptable methods are as follows:
 - a. Hosing with a high pressure jet steam at least twice a day (at midday and quitting time).
 - b. Providing a 1 to 2 inch blanket to dry sand over the exposed surface of the foundation, dislodging hardened mortar from the cell walls and reinforcing using a pole or rod, and removing the mortar debris with the same high pressure jet stream.
13. In the high lift grouting method, intermediate horizontal construction joints are not permitted. Plan construction for one continuous pour of grout to the top of the high lift portion of the wall in 4 foot layers or lifts in the same working day. Should a blowout, a breakdown in equipment, or any other emergency occur, cease the grouting operation. Use procedures as directed by the Architect.
14. To prevent "blowouts" do not pour grout until the mortar has set and cured. However, grout the walls as soon as possible thereafter to reduce shrinkage cracking of the vertical joints. Cleanout closures, reinforcing, bolts and embedded connection items shall be in position before grouting is started. All cells shall be filled with grout.
15. Handle grout from the mixer to the point of deposit in the grout space as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry unit surfaces not being immediately encased in the grout lift. Depending upon weather condition and absorption rates of the masonry units, the lift heights and waiting periods may be varied. Under normal weather conditions, with typical masonry units, limit the individual lifts of grout to 4 feet in height with a waiting period between lifts of 30 to 60 minutes.
16. Place the first lift of grout to a uniform height within the pour section and vibrate thoroughly to fill all voids. This first vibration shall follow the pouring of the grout by not more than 10 feet. Vibrate or consolidate with approved mechanical vibrators.
17. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, pour succeeding lift and vibrate alternate cells by extending vibrator 12 inches to 18 inches into the preceding lift to reconsolidate the preceding lift and close plastic shrinkage cracks or separations from the cell walls.
18. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding lift, reconsolidate each lift by reworking with the vibrator as soon as the grout has taken its settlement shrinkage.
19. Repeat the waiting, pouring and reconsolidating steps until the top of the pour is reached. Also reconsolidate the top lift after the required waiting period and fill space left by settlement shrinkage with grout.

3.09 FIELD QUALITY CONTROL

- A. Inspection tasks and frequency shall be performed in accordance with the Statement of Special Inspections.
- B. Unless indicated otherwise, perform one set of tests for each 5000 sq. ft. of wall area or portion thereof.
- C. Concrete Masonry Units: test per ASTM C 140.
- D. Grout: Test per ASTM C 1019.
- E. Prism Test: For each type of construction indicated, construct and test three prisms per ASTM C 1314 at 28 days.
- F. Masonry Core Test: Core and test per CBC Section 2105A.4 from locations selected by the Design Professional.
- G. Mortar and grout tests: Sample mortar and grout at minimum one-week intervals per CBC Section 2105A.3.

3.10 POINTING, AND CLEANING

- A. Point and tool holes in mortar joints to produce a uniform, tight joint.
- B. During construction, minimize any mortar or grout stains on the wall. Immediately remove any staining or soiling that occurs.
 - 1. For precision or textured units, except as noted below, clean masonry by dry brushing before tooling joints.
 - 2. For burnished concrete masonry units, immediately remove any green mortar smears or soiling with a damp sponge
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Clean exposed cmu walls with a light sandblast. All non-masonry work near the area to be sandblasted shall be covered or protected before the sandblasting starts. Care shall be taken to avoid contamination to areas that are not to be sandblasted.
 - a. Glazed, burnished, or pre-finished masonry units, shall be protected from sandblast operations.
- D. At completion of masonry work, remove all scaffolding and equipment used during construction, and remove all debris, refuse, and surplus masonry material from the site.

END OF SECTION

SECTION 05 05 19
POST-INSTALLED CONCRETE ANCHORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for materials and equipment for post-installed mechanical and adhesive anchors in concrete.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Section 01 45 33 - Code-Required Special Inspections and Procedures: Test reporting.
- C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.
- D. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.
- E. Section 05 50 00 - Metal Fabrications.
- G. Division 26 - Electrical: Mounting of equipment and components.
- H. Other miscellaneous sections, where indicated.

1.03 REFERENCE STANDARDS

- A. ASTM A193/A193M - Standard Specification for Alloy - Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications; 2017.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.
- D. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2018.
- E. ASTM F594 - Standard Specification for Stainless Steel Nuts; 2009 (Reapproved 2015).

1.04 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Product Data: If requested, manufacturer’s product literature and installation instructions for each type of anchor indicated.
- C. Samples: If requested, representative length and diameters of each type of anchor shown on the drawings.
- D. ICC ES Reports: If requested, ICC Evaluation Service report indicating conformance with ICC-ES Acceptance Criteria.
- E. Field quality-control test and inspection reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to 1 and Section 01 45 33 for testing indicated.
- B. Installer Training: Prior to beginning the work, manufacturer or manufacturer's representative shall provide on-site training for all contractor's personnel who will be installing anchors.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in manufacturer's or distributor's original packaging undamaged, and with printed installation instructions.
- B. Store and handle all materials in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Provide products as indicated on the approved Structural Drawings.
- B. Substitutions: Substitutions of products from manufacturer's not listed are not permitted.
 - 1. Substitution of structural anchors requires structural calculations and DSA approval.

2.02 MATERIALS

- A. Interior Use: For use in conditioned environments free from potential moisture, provide zinc plated carbon steel anchors.
- B. Exterior Use:
 - 1. In exposed or potentially wet environments, and for attachment of exterior cladding materials, provide stainless steel anchors.
 - 2. Stainless steel nuts and washers shall be of matching alloy group of equal or greater strength than the rod.
 - 3. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
- C. Deformed Reinforcing Bars: Deformed steel rebar conforming to 1 Grade 60. Permissible sizes as described in each adhesive products ICC report.

2.03 MECHANICAL ANCHORS

- A. Expansion, screw or undercut anchors having current ICC approval for use in cracked and uncracked concrete, with a published ICC Evaluation Service report.
 - 1. Type and size as indicated on drawings.
 - 2. If products are not indicated, then provide anchors as directed by the Architect.
- B. Basis of Design Approved Products conforming to this specification are acceptable for anchoring to concrete are as indicated on Drawings:
 - 1. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Basis of Design Approved Products conforming to this specification are acceptable for anchoring to grouted masonry are as indicated on Drawings:

1. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ADHESIVE ANCHORS

- A. Cartridge Injection Adhesive Anchors: Threaded carbon steel rod, inserts, or reinforcing dowels complete with required nuts, washers, adhesive system and manufacturer's installation instructions.
 1. Type and size as indicated on drawings.
 2. Current ICC approval for use in cracked and uncracked concrete with a published ICC Evaluation Service report required.
- B. Interior Use: Unless otherwise indicated on the Drawings, provide:
 1. Carbon steel threaded rods conforming to specification as indicated on structural drawings. Where no specification and grade are indicated, provide: 2 Type B7 with zinc plating in accordance with 3, Type III Fe/Zn 5 (SC1).
- C. Exterior Use: As indicated on the Drawings, provide stainless steel anchors.
 1. Stainless steel anchors shall be AISI Type 304 and Type 316 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener.
 2. All nuts shall conform to 1, unless otherwise specified.
- D. Basis of Design Approved Products conforming to this specification are acceptable for anchoring to concrete are as indicated on Drawings:
 1. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Basis of Design Approved Products conforming to this specification are acceptable for anchoring to grouted masonry are as indicated on Drawings:
 1. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 CONCRETE AND MASONRY SCREW ANCHORS

- A. Anchors shall be manufactured from carbon steel which is then heat-treated.
 1. Anchors shall be zinc-plated in accordance with 1, Class SC1, Type III.
 2. Current ICC approval for use in cracked and uncracked concrete with a published ICC Evaluation Service report required.
 3. Provide anchors with a diameter and anchor length marking on the head.
 4. If products are not indicated, then provide anchors as directed by the Architect.
- B. Basis of Design Approved Products conforming to this specification are acceptable for anchoring to concrete are as follows:
 1. Simpson Strong-Tie Company, Inc.; Simpson Titen HD anchor, (ICC Report ER-2713) heavy duty screw anchor for concrete; www.simpsonanchors.com.
 2. Hilti, Inc.; Hilti KWIK HUS-EZ (KH-EZ) and KWIK HUS-EZ I (KH-EZ I) Carbon Steel Screw Anchors For Use In Cracked and Uncracked Concrete (ICC Report ESR-3027); www.hilti.com.
 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 POWDER-DRIVEN FASTENERS

- A. Use only if approved by Architect, generally not permitted where not specifically indicated or in load-bearing installations; Fed Spec FF-P-395 or Fed Spec GGG-D-777; as follows.
 - 1. Hilti, Inc.; Hilti Low Velocity Powder Driven Fasteners (ICC Report ESR-1663); www.us.hilti.com.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions
 - 1. Base Material Strength: Unless otherwise specified, do not drill holes in concrete until concrete has achieved full design strength.
 - a. Adhesive anchors shall be installed in concrete having a minimum concrete compressive strength equal to or greater than the specified minimum 28-day compressive strength or a minimum age of 21 days at time of anchor installation. Whichever are more restrictive.
 - 2. Temperature of concrete surface and ambient air temperature must meet manufacturer's requirements prior to use of adhesive anchor products.
 - 3. Embedded Items:
 - a. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors.
 - b. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items.
 - c. Take precautions as necessary to avoid damaging anything embedded in the concrete including electrical/telecommunications conduit, gas pipes, and plumbing pipes.
 - d. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling.
 - 4. Beginning of installation indicates acceptance of existing conditions.

3.02 INSTALLATION

- A. Installation shall comply with all manufacturer's instructions and current ICC ESR report.
- B. Post-Installed Anchors in Hardened Concrete.
 - 1. Drilled-in anchors and/or powder driven pins in existing non-prestressed reinforced concrete: use care and caution to avoid cutting or damaging the existing reinforcing bars.
 - 2. Maintain a minimum clearance of one inch between the reinforcement and the drilled-in anchor and/or pin.
- C. Manufacturer shall provide on-site training for all personnel who will be installing post-installed adhesive anchors at the beginning of the work. Installation of anchors must be performed by a certified installer.
- D. Where manufacturer recommends use of special tools for installation of anchors, such tools shall be used, unless otherwise permitted specifically by the Engineer.

- E. Drill holes with rotary impact hammer drills using carbide-tipped bits. Bits must be of type required and permitted by ICC ESR report.
 - 1. Drill holes with rotary impact hammer drills using carbide-tipped bits or core drills using diamond core bits.
 - 2. Drill bits shall be of diameters as specified by the anchor manufacturer.
 - 3. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
 - 4. Where anchors are to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer.
 - 5. Cored holes may only be used if acceptable to the Engineer and in compliance with ICC ECR report.
- F. Holes shall be cleared of debris after holes are drilled per manufacturer's instructions.
 - 1. For adhesive installations, at a minimum, holes shall be blown out with oil-free compressed air and shall be brushed with a wire or nylon brush.
 - 2. Holes shall than be blown out one additional time with oil-free compressed air.
 - 3. Additional hole cleaning requirements may be required by manufacturer and ICC ESR Report.
- G. During adhesive curing time period, the temperature of the substrate shall be kept above the minimum substrate temperature as defined by the manufacturer. Contractor shall determine the appropriate means and methods to ensure that the temperature is kept above the required minimum temperature required before adhesive installation is begun.

3.03 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 45 33 - Code-Required Special Inspections and Procedures.
- B. Inspection: Special inspection of post-installed anchors shall be provided as required by the ICC-ES report for that anchor and not less than the requirements of the Structural Drawings and the following (whichever is the most restrictive):
 - 1. Continuously observe the installation of all anchors, or as specified in the ICC report.
 - a. Minimum anchor embedments, proof loads and torques shall be as shown on the Drawings.
 - b. Load Testing: Per Structural General Notes on Drawings and CBC 1909.2.7.
 - c. Verify anchor type, anchor dimensions, hole dimensions, anchor spacing, edge distances, anchor embedment and adherence to the manufacturer's published installation instructions.
 - d. For adhesive anchors also verify hole cleaning technique, adhesive expiration date and proper mixing and dispensing.
 - 2. Subsequent inspection of installation will be required when there is a change of personnel doing the installation. Change is defined as any one or more persons drilling or preparing holes, or installing anchors.
 - 3. Visually inspect 100% of all installed anchors.
- C. Reporting:

1. Daily reports shall reference the applicable ICC-ES report number, indicate that all specified criteria were complied with and provide itemized verification of all inspected items.
 2. Special Inspector shall immediately report any deviations from the requirements to the Architect.
- D. Defective Work:
1. Installations that are not accepted by the Special Inspector shall be considered defective.
 2. Provide additional testing and inspection to determine acceptability of defective work, as directed by the Architect at Contractor's expense.

3.04 REPAIR OF DEFECTIVE WORK

- A. Remove and replace misplaced, defective or malfunctioning anchors at Contractor's expense. Replacement of anchors requires signed structural detail, unless otherwise noted.
- B. Fill empty anchor holes and patch failed anchor locations with high-strength, non-shrink non-metallic grout.

END OF SECTION

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Free-standing railings at steps or ramps.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 05 50 00 - Metal Fabrications: Embedded items, welding and shop painting.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).
- E. NAAMM AMP 521 - Pipe Railing Systems Manual; 2001 (reaffirmed 2012).
- F. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
 - 1. Prepare shop drawings for all railing systems, including attachment.
 - 2. Conform to AISC Standards, except provisions for approval/responsibility for dimensions by Architect and structural engineer shall not apply.
 - 3. Include erection drawings, elevations, and details where applicable.
 - 4. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.
- C. Samples: Submit two, 8 inch long samples of handrail. Submit two samples of infill panel.

1.05 QUALITY ASSURANCE

- A. Welder's Qualifications: Welding shall be performed by certified welders qualified in accordance with procedures specified in AWS D1.1/D1.1M, using materials, procedures and equipment of the type required for this work.
- B. Coordination: Provide templates and sleeves for incorporation of embedded items into the work specified elsewhere herein.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Delivery, Storage and Handling, General: Protect products from deformation, marring, discoloration, soiling and corrosion.
- B. Storage: Store products in enclosed, well-ventilated spaces, not in contact with soil or vegetation and not subject to inclement weather.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Regulatory Requirements: Conform to California Building Code (CBC), Title 24, Part 2, Section 11B-505 and 11B-405.8 as amended and adopted by authorities having jurisdiction.
 - 1. Top of gripping surfaces of handrails shall be 34 inches minimum and 38 inches maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above such surfaces.
 - 2. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1-1/2 inches minimum.
 - a. Handrail may be located in a recess if the recess is 3 inches maximum deep and 18 inches minimum clear above the top of the handrail.
 - 3. Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20% of their length.
 - a. Where provided, horizontal projections shall occur 1-1/2 inches minimum below the bottom of the handrail gripping surfaces.
 - 4. Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1-1/4 inch minimum and 2 inches maximum.
 - 5. Handrail gripping surfaces with a non-circular cross section shall have an outside dimension of 4 inches minimum and 6-1/4 inches maximum, and a cross-sectional dimension of 2-1/4 inches maximum.
 - 6. Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.
 - 7. Handrails shall not rotate within their fittings.
 - 8. Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs in accordance with CBC Section 11B-505.10.
 - a. Such extensions are not required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.
 - 9. A 2 inch minimum high curb or a barrier shall be provided to prevent the passage of a 4 inch diameter sphere rolling off the sides of a ramp surface.
 - a. Such a curb or barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2
- B. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

- C. Allow for expansion and contraction of members and building movement without damage to connections or members.
- D. Dimensions: See drawings for configurations and heights.
 - 1. Top Rails and Wall Rails: 1-1/2 inches outside diameter, round.
 - 2. Intermediate Rails: 1-1/2 inches diameter, round.
- E. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- F. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 ALUMINUM MATERIALS

- A. Skateboard Deterrents:
 - 1. Materials: Clear anodized, cast aluminum.
 - 2. Size: Match existing pipe rail outside diameter.
 - 3. Spacing: As indicated on Drawings; minimum 36 inches, on center, approximately 18 inches from ends.
 - 4. Screws: Self-Drilling and threading stainless steel.
 - 5. Manufacturers, or equal:
 - a. Basis of Design: Grind to a Halt, Inc.; Round Handrailminder: www.grindtoahalt.com.
 - b. Ravensforge Coneg LLC: ravensforgeconeg.com/skateblock.
 - c. Skate Stoppers: www.skatestoppers.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.03 STEEL RAILING SYSTEM

- A. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black and galvanized finish, as indicated, seamless or welded.
- B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- C. Exposed Fasteners: No exposed bolts or screws.
- D. Straight Splice Connectors: Steel concealed spigots.
- E. Galvanizing: In accordance with requirements of ASTM A123/A123M.
 - 1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

2.04 FABRICATION

- A. Fabricate railings in accordance with NAAMM AMP 521 and as required for specified design requirements. Provide stock and tubing and manufactured components sized and arranged as indicated on Drawings and specified herein.

- B. Accurately form components to suit specific project conditions and for proper connection to building structure.
 - 1. Prior to fabrication, field verify dimensions and details of construction. Immediately report variances in writing to Architect.
- C. Fit and shop assemble components in largest practical sizes for delivery to site.
- D. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- E. Welded Joints:
 - 1. Exterior Components (Type 2): Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius (1/8 inch).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Coordination: Coordinate fabrication and installation of steel pipe and tube railings so that related Work accurately and properly join.

3.02 PREPARATION

- A. Obtain Architect's review prior to site cutting or making adjustments not indicated on shop drawings.
- B. Supply items required to be cast into concrete with setting templates, for installation as work of other sections.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

3.04 TOLERANCES

- A. Code required dimensions indicated on Drawings as minimum or maximum are absolute. No tolerances are allowed less or more than this dimension.
- B. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

- C. Maximum Offset From True Alignment: 1/4 inch.
- D. Maximum Out-of-Position: 1/4 inch.

3.05 CLEANING AND PROTECTION

- A. Galvanizing Repair Compound:
 - 1. If finish is to be painted or is otherwise not visible, field repair with premixed cold galvanizing compound for field touch-up of galvanized coatings.
 - 2. Where the finish is galvanized, resend to galvanizing for reapplication, if practical (e.g.; bolted components) and accepted by Architect.
- B. Cleaning:
 - 1. Clean and dress all field welds, bolted connections, and abraded areas of galvanizing or shop paint on miscellaneous metal.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, limited to the following:
 - 1. Site Handrails.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. AHRI 340/360 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500 MM (12- to 60-in.) Diameter; 2013.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.
- D. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- F. SSPC-SP 2 - Hand Tool Cleaning; 2018.
- G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 2. MPI product number (e.g. MPI #47).
 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 4. Manufacturer's installation instructions.
 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for District's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 - 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Paints:
 - 1. Behr Process Corporation: www.behr.com/#sle.
 - a. Local representative Jan Piccola 714.679.5730.
 - 2. Dunn-Edwards Corporation: www.dunnedwards.com,
 - a. Local representative Wanda Barragan 909.261.1289.
 - 3. PPG Paints: www.ppgpaints.com/#sle.
 - 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - a. Local representative John Dumesnil 619.665.9341.
 - 5. Vista Paint: www.vistapaint.com.
 - a. Local representative Mark Brower 323.397.9000.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.
- C. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. AHRI 340/360--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - d. Architectural coatings VOC limits of California.
 2. Determination of VOC Content: Testing and calculation in accordance with AHRI 340/360 (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- D. Flammability: Comply with applicable code for surface burning characteristics.
- E. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- F. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.
- B. Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer.
 2. Interior/Exterior Latex Block Filler.
 3. Anti-Corrosive Alkyd Primer for Metal.
 4. Interior/Exterior Quick Dry Alkyd Primer for Metal.
 5. Alkyd Primer for Galvanized Metal.
 6. Water Based Primer for Galvanized Metal.
 - a. Products:

- 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436].
 - 2) Substitutions: Section 01 60 00 - Product Requirements.
7. Rust-Inhibitive Water Based Primer.
 8. Interior/Exterior Quick Dry Primer for Aluminum.
 9. Stain Blocking Primer.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- I. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 2. Prepare surface according to SSPC-SP 2.
- J. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions.
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- F. Sand metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 10 14 00
SIGNAGE**

PART 1 - GENERAL

1.01 SUMMARY:

- A. The work includes the furnishing and installing of exterior signs including accessories as indicated on drawings and specified. The Conditions of the Contract and Division 1 apply to this section as fully as if repeated herein.

1.02 CODES:

- A. Signs identifying facilities that are accessible to persons with disabilities shall conform to the Accessibility Regulations contained in the 2016 California Building Code. See 10 14 00.

1.03 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical data and installation instructions.
- B. Samples: Submit samples of each material showing finishes, colors, surface textures and qualities of manufacturer and design including graphics.
 - 1. Submit full-size sample units, if requested by Architect. Acceptable units may be installed as part of the work.

PART 2 - PRODUCTS

2.01 EXTERIOR LETTERS:

- A. Cast aluminum "Style per Architect" e. Lettering and sizes shall be as indicated. Approved manufacturers, or equal approved in accordance with Section 01 25 00.
 - 1. ASI Sign Systems Inc.
- B. Fasteners: Use concealed fasteners, unless otherwise indicated, which are fabricated from metals which are non-corrosive to either sign materials or mounting surface.
- C. Anchors and Inserts: Use non-ferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
- D. Baked Enamel Finish: Manufacturer's standard non-directional mechanical finish including sanding and filling; cleaning with inhibited chemicals; conversion coated with an acid-

chromate-fluoride-phosphate treatment; and painted with organic coating specified below.

1. Organic Coating: Manufacturer's standard thermosetting enamel system consisting of prime coat and finish coat. Color as selected by Architect from manufacturer's standard.
2. In addition to guarantee requirements specified in the General Conditions, baked enamel finish shall be guaranteed for five years against peeling, cracking, crazing, or blistering.

PART 3 - EXECUTION

3.01 INSTALLATION:

- A. Install signs level, plumb and at proper height.
- B. Exterior Sign: Standoff, 1/2" space between outer projection of wall and letters, 1/8" pins and spacers set in predrilled holes with adhesive.

END OF SECTION

SECTION 26 00 10
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 1.
- B. Definitions, guarantees, submittals, clean-up, "As-Builts" and all other applicable requirements of and Division 1 apply to the work of this section.

1.02 BASIC ELECTRICAL REQUIREMENTS

- A. Quality Assurance:
 - 1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.
 - 2. Refer to other sections of the Specifications for other qualification requirements.
- B. Drawings and Specifications Coordination:
 - 1. For purposes of clearness and legibility, Drawings are essentially diagrammatic and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer's data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.
 - 2. Verify final locations for rough-ins with field measurements and with the requirements of the equipment to be connected.
 - 3. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.
 - 4. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.
 - 5. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.
 - 6. Coordinate electrical equipment and materials installation with building components and the Work of other trades.
 - 7. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 - 8. Coordinate connection of electrical systems with existing underground utilities and services.
- C. Terminology:
 - 1. Signal Systems: Applies to clock, bell, fire alarm, annunciator, sound, public address, buzzer, telephone, television, inter-communication, elevator access controls, lighting control systems and security systems.

2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.
 3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.
- D. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the California Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.
- E. Structural Considerations for Conduit Routing:
1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, conform to ACI 3.8-11 Section 6.3 for conduits and pipes embedded in concrete and Section 2308.9.10 for notches and bored holes in wood; for steel, as detailed on the structural steel Shop Drawings.
 2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doveled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.
 3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.
- F. Electrically Operated Equipment and Appliances:
1. Furnished Equipment and Appliances:
 - a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.
 - b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.
 2. Equipment and Appliances Furnished by Others:
 - a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be provided. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.
 - b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjust-

ment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems with 120V, single phase circuit from nearest electrical panel, furnished under Division 26. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

- c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.
- d. Mechanical equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise.
- e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

G. Protection of Materials:

- 1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

H. Cleaning:

- 1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.
- 2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.
- 3. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

1.03 WARRANTIES

- A. Provide one year warranty on all work performed, unless noted otherwise in specific sections.

1.04 DISCREPANCIES

- A. Where a conflict in requirements occurs between the specifications and drawings, or in the specifications or on the drawings, and a resolution is not obtained from the Engineer before the bidding date, the more expensive alternate will become the contractual requirement.
- B. Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.
- C. The Contractor shall check all drawings furnished him immediately upon their receipt and shall promptly notify the Engineer of any discrepancies. Figures marked on drawings shall in gen-

eral be followed in preference to scale measurements. Large scale drawings shall in general govern small scale drawings. The Contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

1.05 SUBMITTALS

- A. Submit shop drawings, manufacturer's data certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable technical society publication references, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval. Contractor shall be responsible for reviewing and certifying submittals as conforming to the drawings and specifications prior to submittal and shall verify conformance of equipment as delivered with final shop submittals, specifications and plans. Contractor shall report to Engineer any deviations prior to initiation of construction. Contractor is responsible for promptly reporting to Architect any news of late equipment delivery which is likely or certain to delay installation.
1. Submit shop drawings and product data grouped and referenced by the technical Section numbers. Products must be highlighted on the product data sheets.
 2. Submittal/shop drawing shall consist of cover sheet with specification number and the submitted products within the submittal shall be highlighted. Submittals shall be grouped per the related specification number.
 3. Proposed Products List: Include Products as required by the individual section in this Division.
 4. The Contractor shall be responsible for all equipment ordered and/or installed prior to receipt of shop drawings returned from the Engineer bearing the electrical engineer's stamp of "reviewed". All corrections or modifications to the equipment as noted on the shop drawings shall be performed and equipment removed from the job site when required by the Engineer, without additional compensation.
 5. Shop Drawings: Drawings shall be a minimum of 8.5 inches by 11 inches in size with a minimum scale of 1/8-inch per foot, except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, duct work, and other items that must be shown to assure a coordinated installation. In wiring diagrams, identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, revise drawings to show acceptable equipment and resubmit.
 6. Manufacturer's Data: For each manufactured item, provide current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves if applicable, and catalog cuts.
 7. Standard Compliance: When materials or equipment provided by the Contractor must conform to the standards of organizations such as American National Standards Institute

(ANSI) or Underwriters' Laboratories (UL), submit proof of such conformance to the Engineer for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified. In lieu of the label or listing, submit a certificate from an independent testing organization, which is competent to perform acceptance testing and is approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard.

8. Certified Test Reports: Before delivery of materials and equipment, certified copies of all test reports specified in individual sections shall be submitted for approval.
9. Certificates of Compliance or Conformance: Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this contract. Pre-printed certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; or "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certifications shall simply state that the item conforms to the requirements specified. Manufacturer shall use Form 260010-A for equipment installation certification. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance or conformance.

1.06 GUARANTEE

- A. Except as may be specified under other sections in the Specifications, guarantee all equipment furnished under the Specifications for a period of one year from date of project acceptance against defective workmanship and material and improper installation. Upon notification of failure, correct deficiency immediately and without cost to the Owner.
- B. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner for their service agency as directed. Furnish manufacturer's warranties for all equipment furnished under this project.

1.07 MANUFACTURER'S RECOMMENDATIONS

- A. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Advise the IOR before starting the Work of this Division.
- B. Exposed conduits shall be painted to match the surfaces adjacent to installation.
- C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.
- D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the IOR. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to students and staff.
- E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be 3 inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling or similar prior to lay out.
- F. Electrical equipment shall be braced and anchored per 2016 CBC CH 16A, Section 1616A.1.23 through 1616A.1.26 seismic requirements, or as otherwise indicated on the Drawings.

3.02 WORK RESPONSIBILITIES

- A. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgement must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference with structural conditions. The contractor is responsible for the correct placing of his work and the proper location and connection of his work in relation to the work of other trades. Advise appropriate trade as to locations of access panels.
- B. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost, providing the change is ordered before the conduit runs, etc. and work directly connected to same is installed and no extra materials are required.
- C. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.
- D. Do not install light outlets or fixtures until mechanical piping and duct work is installed; then lights shall be installed in locations best suited for equipment arrangement or as directed by the Engineer.
- E. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with any work, carefully check and verify all dimensions, sizes, etc. with the shop drawings to see that the equipment will fit into the spaces provided without violation of applicable codes.
- F. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Engineer immediately and cease work on all parts of the contract which are affected until approval for any required modifications to the construction has been obtained from the Engineer.

- G. Be responsible for any cooperative work which must be altered due to lack of proper supervision or failure to make proper provisions in time. Such changes shall be under direction of the Engineer and shall be made to his satisfaction.
- H. Perform all work with competent and skilled personnel.
- I. All work, including aesthetic as well as electrical and mechanical aspects of the work, shall be of the highest quality consistent with the best practices of the trade.
- J. Replace or repair, without additional compensation, and any work which, in the opinion of the Engineer, does not comply with these requirements.

3.03 OPERATION AND MAINTENANCE MANUAL

- A. Provide operation and maintenance manual of all equipment and lighting fixtures furnished on this project

3.04 POSTED OPERATING INSTRUCTIONS:

- A. Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions as directed. Attach or post operating instructions adjacent to each principal system and equipment including startup, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each system or equipment. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

3.05 MANUFACTURER'S RECOMMENDATIONS:

- A. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

3.06 DELIVERY STORAGE AND HANDLING

- A. Deliver products to project site with proper identification, which shall include names, model numbers, types, grades, compliance labels, and similar information needed for District identification; all products and materials shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion.

3.07 CUTTING AND PATCHING

- A. Cutting and patching of electrical equipment, components, and materials shall include the removal and legal disposal of selected materials, components, and equipment.
- B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

- C. Repair or restore other work, or surfaces damaged as a result of the work performed under this contract.

3.08 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose off the Project site.
- B. Remove equipment and implements of service, and leave entire work area neat and clean, to the satisfaction of the Owner Authorized Representative.

3.09 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 260533 "Raceways and Boxes for Electrical Systems"
 - 2. Section 260553 "Identification for Electrical Systems."

1.03 DEFINITIONS

- A. ASTM: American Society of Testing Materials.
- B. ICEA: Insulated Cable Engineers Association.
- C. IEEE: Institute of Electrical & Electronics Engineers.
- D. NEMA: National Electrical Manufacturers Association.
- E. NETA ATS: InterNational Electrical Testing Association - Acceptance Testing Specification.
- F. VFC: Variable frequency controller.

1.04 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of product, indicating conductor/cable construction, insulation material, thickness of insulation, jacket, cable stranding, and voltage rating of each type of conductor/cable specified, splices and terminations. Indicate date and place of manufacture for each conductor/cable, cable, splice and termination.
- B. Manufacturer's ISO certification.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Independent Testing Agency.
- B. Field quality-control reports. Perform field testing of cables per para 3.8. Submit six (6) copies of field test reports to owner's representative within two (2) weeks of completion of test.

1.06 QUALITY ASSURANCE

- A. General Requirements: The low voltage power conductors and cable shall be copper, minimum 600V rated unless otherwise indicated. Aluminum conductors and cables shall not be accepted unless otherwise indicated.

- B. Materials and installation shall meet or exceed requirements in the following referenced standards and shall be listed and labelled by UL.
 - 1. ICEA S-93-639/ NEMA WC 74.
 - 2. AEIC CS8.
 - 3. UL 1072.
 - 4. IEEE.
 - 5. ASTM.
 - 6. NEMA.
- C. Conductors and cables shall be of the same manufacturer, and shipped to the job site in original unbroken reels.
- D. Conductors and cables shall be manufactured within twelve (12) months of installation. Date of manufacture shall be clearly marked on conductors or conductor reels.
- E. Manufacturer shall have minimum ten (10) years experience in the manufacture of conductors and cables similar to those specified on this project.
- F. Manufacturer shall have ISO 9001 and ISO 9002 certification.
- G. All conductors and cables shall be new and supplied by a local distributor.
- H. American made conductors and cables have been acceptable. If non-domestic product is submitted, notice is hereby given that extensive testing shall be required to insure quality and conformance to the Specifications. All of the testing procedures and results shall be satisfactory to the Owner's representative. The Contractor shall bear all costs for testing and shall be responsible for all costs associated with travel, lodging, etc. for the Owner's Representative to witness the test at the manufacturer's testing facility. The Contractor shall reimburse the Owner at \$1,200 per man day or part thereof for the time required to witness the testing.
- I. Testing: Provide the services of an independent qualified testing laboratory to perform the specified field tests. Notify the Owner's Representative fourteen (14) days in advance of performance of work requiring testing.
- J. Conductors, cables, splices and terminations shall be manufactured within twelve (12) months of installation. Each item shall have a permanent marking on the product or the original manufacturers' package indicating the date of manufacture unless otherwise noted.
- K. Testing Agency Qualifications:
 - 1. Testing agency shall be an independent company; shall have been a member of NETA for a minimum of last ten (10) years and has permanent in-house testing engineers and technicians involved with testing of low voltage electrical power conductors and cables similar to those specified on this project.
 - 2. Testing company shall be located within 50 miles radius of the project.
 - 3. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
 - 4. Field Testing technician and supervisor shall have minimum ten (10) years' experience in field testing of low voltage power conductors and cables of the type and rating similar to the conductors and cables to be tested on this project.

PART 2 PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. General Cable Technologies Corporation.
 - 2. Southwire Incorporated
 - 3. Alpha Wire.
- B. Conductor Material: Electrical grade, soft drawn annealed copper, 98 percent conductivity, and fabricated in accordance with ASTM and IPCEA standards. Minimum size is number 12 for branch circuits, number 14 stranded for control wiring. Aluminum conductors are not permitted. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 or Type XHHW-2.
- D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type SO and with ground wire.
- E. VFC Cable:
 - 1. Comply with UL 1277, UL 1685, and CEC for Type TC-ER cable.
 - 2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.
 - 3. Comply with UL requirements for cables in direct burial applications.
- F. Provide separate neutral with each branch circuit serving outlets. When dedicated neutrals are provided, use color spiral to match associated phase.

2.02 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Ideal Industries, Inc.
 - 2. IlSCO; a branch of Bardes Corporation.
 - 3. NSI Industries LLC.
 - 4. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 5. 3M; Electrical Markets Division.
 - 6. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Copper conductors shall be terminated in copper or bronze mechanical connectors or lugs or tool applied compression connections made of copper for all connections except those on wiring devices.
- D. Splices in wires No. 10 and smaller shall be made with twist-on splicing connector in accordance with UL486-C. Connections in wires No. 8 and larger shall be made with compression type connectors in accordance with UL486-A and wrapped with insulated tape in

accordance with UL501. Insulating tape shall be applied in a minimum of two layers of half wrap or built to match the overall insulation of the wire.

- E. Splices in underground pull boxes shall be made submersible type and made using "3M" Scotch-cast epoxy kits.
- F. Pressure type connectors are not permitted.

2.03 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Comply with CEC.

PART 3 EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway
- B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THWN-2, single conductors in raceway
- G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- H. VFC Output Circuits: Type XHHW-2 in metal conduit with braided shield.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. All conductors and cables shall be installed in a raceway.
- B. Before installing conductors and cables in existing conduits, verify the continuity of each conduit; each surface conduit is properly supported per code and clear of any debris.

- C. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors].
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 IDENTIFICATION

- A. Each conductor shall be factory color coded by conductor manufacturer. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance conductors, feeder conductors and the conductors feeding the following critical equipment and services for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical tests stated in latest NETA Acceptance Testing Specification section 7.3.2 (Inspection and Test Procedures-Cables, Low Voltage-600V Maximum). Certify compliance with test parameters per NETA tables.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 1. Procedures used.
 2. Results that comply with requirements. Include color scan images.
 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Retain or delete this article in all Sections of Project Manual.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes: Grounding systems and equipment.
- B. Section includes grounding systems and equipment, plus the following special applications:
 - 1. Overhead-line grounding.
 - 2. Underground distribution grounding.
 - 3. Ground bonding common with lightning protection system.

1.03 DEFINITIONS:

- A. NETA ATS: InterNational Electrical Testing Association - Acceptance Testing Specification.
- B. NETA MTS: InterNational Electrical Testing Association - Maintenance Testing Specification.
- C. CEC: California Electrical Code

1.04 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical catalog cuts for each type of product indicated.
- B. Shop Drawings: Site drawings to scale including details showing location and size of each field connection of grounding system.
 - 1. Wiring Diagrams: Differentiate between manufacturer installed and field installed wiring.

1.05 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans drawn to scale (1/4"=1'-0") showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding conductors, connectors.
 - 5. Grounding arrangements and connections for separately derived systems.
 - 6. Grounding for sensitive electronic equipment.
- B. Qualification Data: For qualified independent testing agency and testing agency's field supervisor.
- C. Field quality-control reports. Submit written test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. include the following:
 1. Instructions for periodic testing and inspection of grounding features at test wells based on NETA MTS.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 1. Testing agency shall be an independent company; shall have been a member of NETA for a minimum of last ten (10) years and has permanent in-house testing engineers and technicians involved with testing of grounding systems similar to those specified on this project.
 2. Testing company shall be located with 50 miles radius of the project.
 3. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
 4. Field Testing technician and supervisor shall have minimum ten (10) years' experience in field testing of rounding systems of the type and rating similar to the systems to be tested on this project.
- B. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.01 GROUNDING ELECTRODES, CONDUCTORS, CONNECTOR, BUS:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or equal:
 1. Grounding Connectors, Bars and Rods:
 - a. Erico Inc.; Electrical Product Group
 - b. Framatome Connectors/Burndy Electrical.
 - c. Ideal Industries, Inc.
 - d. O-Z/Gedney Co.; a business of the EGS Electrical Group.

- e. Thomas & Betts, Electrical.
- 2. Grounding Conductors and cables:
 - a. Southwire
 - b. American Insulated Wire
 - c. Okonite

2.02 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
 - 1. No. 4 AWG minimum, soft-drawn copper.
 - 2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.
- D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.03 CONNECTORS

- A. Listed and labeled by UL for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch in diameter by 10 feet in length.

- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
 - 2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 EXECUTION

All grounding shall be in accordance with CEC article 250.

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING OVERHEAD LINES

- A. Comply with IEEE C2 grounding requirements.
- B. Install two parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.
- C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.
- D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

- E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.
- F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.
- G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.03 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- C. Install #4/0 bare copper ground wire loop around the outside perimeter of the manhole, in soil, 12" above bottom of manhole. Cadweld ground wire loop to #4/0 bare copper ground wire connecting all exposed metal parts inside the manhole through a 1" opening at the top of manhole wall. Seal and waterproof opening after wire installation.
- D. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- E. Pad-Mounted Transformers and Medium Voltage Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 1/0 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.04 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits in the same conduit containing phase and neutral conductors. Comply with CEC, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by CEC are indicated.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by CEC :
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
 4. All metallic conduits and cable tray shall be continuously bonded to maintain low resistance ground path and bonded back to the central equipment by the use of bonding jumpers where needed.

3.05 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade using exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install ground rods at least three rods, spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
 - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Separately Derived System (SDS): All multiple branch metal water piping laterals originating from outside the area being served by the SDS and which serve the same area being served by the SDS shall be bonded to the common grounding electrode (GE) or the common grounding electrode conductor (GEC). The bonding connection shall be

made at each level that the metal water piping serves. When multiple SDS's are installed or a SDS serves multiple levels of a structure, a copper common GEC shall be installed for the SDS as permitted in CEC article 250.30 (D)3 and sized per article 250.30 (A) and (B).

3. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 4. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to CEC; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.06 LABELING

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent qualified testing agency to perform tests and inspections. Refer to section
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- E. Grounding system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and less: 10 ohms.
 2. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 3. Substations and Pad-Mounted Equipment: 5 ohms.
 4. Manhole Grounds: 10 ohms.
- H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner's Representative promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
 - 7. Handholes and boxes for exterior underground cabling.
- B. Related Requirements:
 - 1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.03 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. EMT: Electrical metal tubing
- C. ENT: Electrical non-metallic tubing
- D. GRC: Galvanized rigid steel conduit.
- E. HDPE: High density polyethylene pipe
- F. IMC: Intermediate metal conduit.
- G. LFMC: Liquidtite flexible metal conduit
- H. LFNC: Liquidtite flexible non-metallic conduit.
- I. RNC: Rigid non-metallic conduit
- J. RTRC: Reinforced thermosetting resin conduit

1.04 QUALITY ASSURANCE:

- A. Each conduit shall bear manufacturer's trademark and UL label.
- B. Each type of conduit and fittings shall be of a single manufacturer. Multiple manufacturer's of the same material are not acceptable.
- C. Comply with California Electric Code (CEC)

1.05 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Samples: For wireways and surface raceways and for each color and texture specified, 12 inches long.

1.06 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 2. O-Z/Gedney; a brand of EGS Electrical Group.
 - 3. Republic Conduit.
 - 4. Robroy Industries.
 - 5. Thomas & Betts Corporation.
 - 6. Western Tube and Conduit Corporation.
 - 7. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be UL listed and labeled as defined in NFPA 70, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.

- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch, minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. FMC: Comply with UL 1; zinc-coated steel.
- I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and CEC.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in CEC, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CANTEX Inc.
 - 2. Condux International, Inc.
 - 3. Electri-Flex Company.
 - 4. Lamson & Sessions; Carlon Electrical Products.
 - 5. RACO; a Hubbell company.
 - 6. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- I. RTRC: Comply with UL 1684A and NEMA TC 14.
- J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

- K. Fittings for LFNC: Comply with UL 514B.
- L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman; a Pentair company.
 - 3. Mono-Systems, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 for indoor dry locations and Type 4X stainless steel for outdoor, damp and wet locations unless otherwise indicated, and sized according to CEC. Metal wireways installed outdoors shall be UL listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated. Refer to drawings for additional information.
- E. Finish: Manufacturer's standard enamel finish.

2.04 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be UL listed and labeled as defined in NFPA 70, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Wiring Systems
 - b. Wiremold / Legrand.
 - c. Mono-Systems, Inc.
 - d. Panduit Corp.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hubbell Incorporated; Wiring Device-Kellems Division.
 - b. Wiremold / Legrand.
 - c. Mono-Systems, Inc.
 - d. Panduit Corp.
- D. Tele-Power Poles:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems Division
 - b. Wiremold / Legrand.Mono-Systems, Inc.
 - c. Panduit Corp.
 - 2. Material: Aluminum with clear anodized finish.
 - 3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.05 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 2. EGS/Appleton Electric.
 - 3. Hoffman; a Pentair company.
 - 4. Hubbell Incorporated; Killark Division.
 - 5. O-Z/Gedney; a brand of EGS Electrical Group.
 - 6. Robroy Industries.
 - 7. Thomas & Betts Corporation.
 - 8. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Metal Floor Boxes:
 - 1. Material: Sheet metal unless otherwise indicated.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
 - 1. Listing and Labeling: Paddle fan outlet boxes shall be UL listed and labeled as defined in NFPA 70, and marked for intended location and application.

- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: Minimum 4 inches square by 2-1/8 inches deep.
- L. Gangable boxes are prohibited.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 for indoor dry locations and Type 4X stainless steel for outdoor, damp and wet locations. Enclosures shall have continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. Cabinets:
 - 1. NEMA 250, Type 1 galvanized-steel box for indoor dry locations and type 4X stainless steel for outdoor, damp and wet locations. Each cabinet shall have removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

2.06 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Christy Concrete Products.
 - 2. Oldcastle Precast Group.
 - 3. Jensen Precast
- C. Comply with ASTM C 858 for design and manufacturing processes.
- D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have traffic 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. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 - 3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 4. Cover Legend: Molded lettering, "GWC ELECTRIC." Refer to drawings for additional information.

5. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
6. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension shall provide increased depth of 12 inches.
 - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
7. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
8. 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.
9. 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.
10. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.07 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC. Inside concrete walls and columns only.
 3. Underground Conduit: Type EPC-40-PVC or Type EPC-80-PVC, direct buried, concrete encased as indicated. All raceways containing medium and high voltage conductors and

- cables shall be encased in 3000 psi red concrete. Red color shall be factory premixed during manufacture using 1-1/2 lbs of red ocher dye in one sack of cement.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4 X stainless steel.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT. Raceway locations include above suspended ceilings, unfinished dry spaces.
 2. Exposed: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Electrical, Mechanical and Elevator Machine rooms.
 - d. Gymnasiums.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 4. Concealed in concrete walls and columns: RNC Type EPC-40-PVC.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1 for indoor dry locations , except use NEMA 250, Type 4X stainless steel in kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F .

3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with CEC limitations for types of raceways allowed in specific occupancies and number of floors.

- B. Provide separate raceways for normal and emergency power wiring, low, medium and high voltage wiring, communication system wiring, fire detection and alarm system, signal and control system wiring.
- C. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- D. Complete raceway installation before starting conductor installation.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions unless otherwise indicated.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from RNC, Type EPC-40-PVC to GRC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 250lbs (113 kgs) tensile strength. Leave at least 12 inches of slack at each end of pull wire. Provide acrylic identification tags (2"X4") at each end indicating the source. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- T. Install raceway sealing fittings at accessible locations according to CEC and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to CEC.
- U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by CEC.
- V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- W. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations.
- Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- BB. Locate boxes so that cover or plate will not span different building finishes.
- CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- EE. Set metal floor boxes level and flush with finished floor surface.
- FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit.
 2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction
 3. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a

minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances. Top of conduits inside the handhole/box shall be minimum 4 inches above the bottom of the handhole/box unless otherwise indicated.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel (minimum 6 inch high), graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, Refer to drawings for additional information.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.06 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 43
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks.
 - 2. Handholes and boxes.
- B. Related Requirements:
 - 1. Section 260526 "Grounding and Bonding of Electrical Systems".

1.03 DEFINITION

- A. RNC: Rigid nonmetallic conduit.
- B. PVC coated GRS: PVC coated Galvanized rigid steel conduit
- C. PVC: Poly Vinyl Chloride
- D. NETA: InterNational Testing Association
- E. UL: Underwriter Laboratories

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Duct-bank materials, including separators and miscellaneous components.
 - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Accessories for handholes, boxes, and other utility structures.
 - 4. Warning tape.
 - 5. Warning planks.
 - 6. Pull ropes.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Reinforcement details.
 - 3. Grounding details.
 - 4. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.
 2. Cover design. Include details of factory engraved markings as specified.
 3. Grounding details.
 4. Cable racks, inserts. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- D. Sustainable Design Submittals:
1. Product Data: For adhesives and sealants, indicating VOC content.
 2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

1.05 INFORMATIONAL SUBMITTALS

- A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 2. Drawings shall be signed and sealed by a qualified California registered professional electrical engineer.
- B. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858. Certificates shall be signed by manufacturer's California registered professional structural engineer. Include name and date.
- C. Qualification Data: For professional engineer and testing agency.
- D. Source quality-control test reports. Certified test reports signed by Factory Engineer indicating, actual test data, analysis of the test results, date and location and of the tests.
- E. Field quality-control test reports.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Comply with ANSI C2.
- C. Each conduit shall bear manufacturer's trademark and UL label. Conduits and fittings shall be of a single manufacturer. Multiple manufactures for the same material are not acceptable.
- D. Comply with California Electric Code (CEC).

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Deliver precast concrete handholes and other underground utility structures when the site is ready for installation. Store precast concrete and other factory-fabricated underground utility structures at Project site (if necessary) as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.08 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Architect and Owner no fewer than fourteen (14) days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Architect's and Owner's written permission.
 - 3. Existing electrical service shall be shut down by owner's authorized personnel. Coordinate with owner in advance.

1.09 COORDINATION

- A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Verify existing utilities within the project area using an independent electronic locator service. Pot-hole using vacuum pot holing equipment to find the exact location of existing underground utilities minimum two weeks prior to start of excavation work.
- B. Coordinate elevations of ducts and duct-bank entrances into handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to handholes, and as approved by Architect.

PART 2 PRODUCTS

2.01 CONDUIT

- A. RNC: Heavy wall design; NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B. Make all fittings watertight with solvent-weld recommended by the conduit manufacturer and specifically manufactured for the purpose.

2.02 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Tube and Conduit
 - 2. Cantex, Inc.
 - 3. Lamson & Sessions; Carlon Electrical Products.
 - 4. JM Eagle
- B. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
 - 2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
 - a. Color: Red dye added to concrete during batching.
 - b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

2.03 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Christy Concrete Products.
 2. Oldcastle Precast Group.
 3. Jensen Precast
- B. Comply with ASTM C 858 for design and manufacturing processes.
- C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have traffic 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. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 3. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 4. Cover Legend: Molded lettering, "GWC ELECTRIC." ""
 5. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
 6. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension shall provide increased depth of 12 inches.
 - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
 7. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
 8. 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.

9. 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.

2.04 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Description: Comply with SCTE 77.
 1. Color: Gray.
 2. Configuration: Units shall be designed for flush burial and have open or closed bottom, as specified.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, "GWC ELECTRIC."
 6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.05 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified California registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 EXECUTION

3.01 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-40-PVC, in red concrete-encased duct bank, unless otherwise indicated. Concrete shall be premixed during manufacture using 1-1/2 lbs of red ocher dye per one sack of cement. Sprinkling red color in the field is not acceptable.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

- C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated. Underground ducts in planter areas shall have 6 inches of sand below and 2 inches of lean concrete on the top.
- D. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- E. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank, unless otherwise indicated.
- F. Underground Ducts Crossing Walks and Driveways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.02 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

3.03 EARTHWORK

- A. Excavation and Backfill: do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- 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.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures

3.04 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated. For underground ducts containing MV and HV cables, use manufactured long sweep bends with a minimum radius 25 feet (7.5 m) both horizontally and vertically. Number of bends on ducts for HV and MV systems, telephone and signal systems shall not exceed two (2) 90 degrees.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

- D. Installation Adjacent to High-temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line. Maintain minimum 12 inch separation unless the calculations require more separation.
- E. Installation Adjacent to Other Utilities: Where ducts are installed parallel to other utilities e.g. communication, sound maintain minimum 12 inches of separation from any ducts containing power feeders, light circuits.
- F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to handhole.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- G. Building Wall Penetrations: Make a transition from underground duct to pvc coated rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- H. Do not install conduits underneath a building except where the service/feeder/branch circuit conduits enter the building.
- I. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psi hydrostatic pressure.
- J. Pulling Cord: Install minimum 1/8 inch thick test nylon cord with minimum 250 pounds per foot tensile strength in ducts, including spares.
- K. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 2. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

3. Encase all feeder ducts in a 3 inch concrete envelope. Extend envelope with 3 inches beyond all external surfaces of all outer most ducts. Do not over pour the concrete.
4. Concrete encasement shall be minimum 3000 psi. All underground ducts containing MV and HV cables (above 600V) shall be encased in red concrete. Concrete shall be premixed during batching with 1-1/2 lbs of red ocher dye per sack of cement.
5. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
6. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
7. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, and 12 inches (300 mm) between power and signal ducts.
8. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 36 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated. Minimum depth below grade in all areas shall be 36 inches (900 mm) for underground ducts containing MV and HV ducts.
9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
10. Warning Tape: Bury warning tape approximately 12 inches below grade above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

L. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms
4. Install backfill
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use

hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction

6. Install ducts with a minimum of 3 inches between ducts for like services and 12 inches (300 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
11. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.05 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES

A. Precast Concrete Handhole 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 12 inches thick crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Install handholes with bottom below the frost line, below grade.
2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.

C. 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.

3.06 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

- B. Unless otherwise indicated, support units on a level bed of 12 inches thick crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and traffic ways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 - 1. Concrete: 3000 psi, 28-day strength with a troweled finish.
 - 2. Dimensions: 10 inches wide by 12 inches deep.

3.07 GROUNDING

- A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.08 FIELD QUALITY CONTROL

- A. During construction, partially completed duct lines shall be protected from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs. As each section of a duct line is completed from manhole to vault, a testing mandrel not less than 12 inches long with a diameter 1/4-inch less than the size of the duct, shall be drawn through each duct, after which a brush having the diameter of the duct, and have stiff bristles shall be drawn through until the conduit is clear of all particles of earth, sand, gravel and other foreign materials. Conduit plugs shall then be immediately installed. Underground conduits, which terminate inside the building below grade, or which slope so that water might flow into building, shall be sealed at termination after installation of wires.
- B. Perform the following tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
- C. Correct deficiencies and retest as specified above to demonstrate compliance.

3.09 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
 - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
- b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel.
 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, water stop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following manufacturers:
 - a. Presealed Systems.

2.04 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position water stop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.03 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's catalog cut sheets for each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.04 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969. Adhesive type labels shall be used for only applications indicated in this section.

1.05 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.01 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Feeders and Circuits at 600 V or Less:
 - 1. Black letters on an orange field
 - 2. Legend: Indicate voltage and system or service type.
- C. Colors for Raceways Carrying Feeders and Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.
- G. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

2.02 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Colors for Cables Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.
- E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

2.03 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.
- D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.
- F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.04 CONDUCTOR AND CABLES IDENTIFICATION MATERIALS

- A. Color coding of conductors: Provide color coded insulation by conductor manufacturer. Coordinate with Division 26, Section 260526 "Low Voltage Electrical Power Conductors and Cables". If permitted by owner's representative in writing, install color coding conductor tape for temporary installations only.
- B. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- F. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- G. Medium voltage cable tag: Laminated Micrata type, 5" x 3½", nameplates engraved with 5/32-inch high black letters on white background for normal power and red letters on white background for emergency power.
 - 1. Feeder or circuit number.
 - 2. Size of MV cable and equipment grounding conductor.
 - 3. Point of origin and point of destination.

4. Date of installation
 5. Name of installing contractor
- H. Provide tags on each pull rope of spare conduits showing starting point and end point of spare conduits.

2.05 FLOOR MARKING TAPE

- A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.06 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
1. Comply with ANSI Z535.1 through ANSI Z535.5.
 2. Inscriptions for Red-Colored Tapes: CAUTION-BURIED ELECTRIC LINE, HIGH VOLTAGE.
 3. Inscriptions for Orange-Colored Tapes: CAUTION-BURIED TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
- C. Tag: Type IID :
1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 2. Width: 6 inches
 3. Overall Thickness: 5 mils.
 4. Foil Core Thickness: 0.35 mil.
 5. Weight: 34 lb/1000 sq. ft.
 6. Tensile according to ASTM D 882: 300 lbf and 12,500 psi .

2.07 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 2. 1/4-inch grommets in corners for mounting.
 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.
 3. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
 3. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 60 INCHES."
 4. High Voltage Equipment Warning "DANGER - HIGH VOLTAGE - KEEP OUT".
 5. Provide other warning labels and signs as required by applicable code and regulation.

2.08 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
1. Engraved legend with black letters on white face. <Insert colors for other applications>.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.09 EQUIPMENT IDENTIFICATION LABELS

- A. Stenciled Legend: Provide stenciled labels to identify major equipment numbers (e.g. transformers, MV switches etc) indicated on drawings, in nonfading, waterproof, black ink or paint. Minimum letter height shall be 2 inch. Verify letter height with Owner's representative prior to start of work. Stencil labels shall be provided in addition to engraved laminated labels specified in para D below.
- B. Labels shall include the following information. Color of nameplate shall be black for equipment connected to normal power, red for equipment connected to emergency power, and blue for equipment connected to Un-interruptible Power Supply. Color of letters shall be white.
1. Panel or equipment designation.
 2. Rating: Volt, Amps, No. of phase and wires, horsepower, etc.
 3. AIC Rating (RMS Symmetrical Amps).
 4. Fed from information.
 5. Manufacturer Shop Order number.
 6. Date of Installation.
 7. Other information as requested by Owner.
- C. For medium-voltage switchgear:
1. Use 1 inch to identify equipment designation
 2. Use 3/4 inch to identify voltage rating and source

3. Use 1/2 inch to identify individual feeder breakers and buckets
 4. Use 1/4 inch to identify control switches, indicating lights, and other miscellaneous devices on the bucket door.
- D. Adhesive labels and nameplates are not acceptable. Attach labels and nameplates with cadmium plated screws.

2.10 WIRING DEVICES LABELS

- A. Identify wiring devices with heavy duty clear vinyl polyester tape "Weber" unless otherwise indicated. Provide labels on the device cover plate made of non-metallic materials. Color of letters shall be black for device connected to normal power, color of letters shall be red for device connected to emergency power. Labels shall be printed, flexible, self-adhesive type. In addition write the circuit no. (e.g. 1PA-2) on the inside of the device cover plate of non-metallic material using a permanent marker.
- B. For stainless steel cover plates, engrave information on the device cover plate.
- C. Device (receptacles, switches etc.) label shall include panel designation and circuit number.

2.11 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F.
 5. Color: Black.

2.12 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to raceways concealed within wall.
 - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot maximum intervals.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label bands. Install labels at 10-foot maximum intervals.
- D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power
 2. Power
 3. UPS
- E. Power-Circuit Conductor Identification, 600V or less: Provide factory color coded conductors as indicated in Division 26 "Low Voltage Power Conductors and Cables". Color coding tape may be field applied (if specified on the documents or permitted in writing by Owner's representative) to identify phase conductors in vaults, pull and junction boxes, manholes, handholes and other locations where conductors are spliced and terminated. Colors for factory-assembled cable, such as MC and AC, must match colors listed in first paragraph below. .
1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service, feeders and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral : White
 - 5) Ground Green
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral : Grey
 - 5) Ground : Green
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- F. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use Laminated Micrata type, 5" x 3½", nameplates engraved with 5/32-inch high black letters on white background for normal power and red letters on white background for emergency power. Include the circuit designation to match owner's existing standard. Verify with owner's representative prior to making labels.
- G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes self-adhesive vinyl labels with the conductor designation.
- J. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

- K. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- L. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
 - 2. During backfilling of trenches install continuous underground-line warning tape directly above the line at 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- M. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- N. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- O. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- P. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer, load shedding..
- Q. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems. Verify requirements with Owner's representative.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label listed for outdoor application.

- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment to Be Labeled:
- a. Panelboards: Typewritten directory of circuits in the location provided by panel board manufacturer. Panelboard identification shall be engraved laminated acrylic label.
 - b. Enclosures, electrical, telecom, alarm and communication system cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Enclosed circuit breakers.
 - e. Enclosed controllers.
 - f. Push-button stations.
 - g. Contactors.
 - h. Remote-controlled switches, dimmer modules, and control devices.
 - i. Monitoring and control equipment.
 - j. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
 - k. Fire detection and alarm panels.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge-suppression units.
 - 4. Isolated-ground receptacles.
 - 5. Tamper-resistant receptacles.
 - 6. Weather-resistant receptacles.
 - 7. Snap switches and wall-box dimmers.
 - 8. Solid-state fan speed controls.
 - 9. Wall-switch and exterior occupancy sensors.
 - 10. Communications outlets.
 - 11. Pendant cord-connector devices.
 - 12. Cord and plug sets.
 - 13. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.06 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.08 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer. Switches, receptacles and cover plates shall be of the same manufacturer.
- B. Comply with National Electrical Manufacturer's Association (NEMA) standards. Furnish products listed and classified by Underwriter's Laboratories Inc. as suitable for purpose specified and shown.
- C. Manufacturer shall have a minimum of ten (10) years' experience in the production of wiring devices specified and shall have ISO 9001 and 9002 certifications.
- D. Materials and equipment shall be new, modern in design and shall not have been in prior service except as required by factory tests.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 2. Leviton Mfg. Company Inc. (Leviton).
 - 3. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: UL Listed and labeled and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - a. Hubbell; HBL5361 (single), HBL5362 (duplex).
 - b. Leviton; 5361 (single), 5362 (duplex).
 - c. Pass & Seymour; 5361 (single), 5362 (duplex).

2. Description: Grounded, industrial extra heavy duty specifications grade, back- and side-wired, single-piece grounding brass strap with integral ground, impact-resistant thermoplastic nylon cover and body, smooth face, with separate grounding screw and NEMA 5-20R plug configurations.
- B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - a. Hubbell; HBL8300SGA.
 - b. Leviton; 8300-SGG.
 - c. Pass & Seymour; TR63H.
 2. Description: Grounded, specifications grade, back- and side-wired, single-piece grounding brass strap with integral ground, impact-resistant thermoplastic nylon cover and body, smooth face, with separate grounding screw and NEMA 5-20R plug configurations.
 3. Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.04 GFCI RECEPTACLES

- A. General Description:
1. Straight blade, feed-through type.
 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
 4. Include self-test feature so that the outlet is automatically tested every fifteen minutes.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - a. Hubbell; GFR5352L.
 - b. Pass & Seymour; 2095.
 - c. Leviton; 7590.

2.05 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - a. Hubbell; HBL2310.
 - b. Leviton; 2310.
 - c. Pass & Seymour; L520-R.

2.06 PENDANT CORD-CONNECTOR DEVICES

- A. Description:
1. Matching, locking-type plug and receptacle body connector.
 2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.

3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.07 CORD AND PLUG SETS

- A. Description:
 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.08 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
 1. Products: Subject to compliance with requirements,
 - a. Single Pole:
 - b. Hubbell; HBL1221.
 - c. Leviton; 1221-2.
 - d. Pass & Seymour; CSB20AC1.
- C. Pilot-Light Switches, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following manufacturers:
 - a. Hubbell; HBL1201PL for 120 and 277 V.
 - b. Leviton; 1221-LH1.
 - c. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.
 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."
- D. Key-Operated Switches, 120/277 V, 20 A:
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Hubbell; HBL1221L.
 - b. Leviton; 1221-2L.
 - c. Pass & Seymour; PS20AC1-L.
 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.09 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.10 FLOOR SERVICE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Hubbell Inc.
 - 2. Wiremold/Legrand.
- B. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- C. Compartments: Barrier separates power from voice and data communication cabling.
- D. Service Plate: Rectangular, with satin finish.
- E. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- F. Voice and Data Communication Outlet: See IT and AV documents and specifications for requirements.

2.11 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Wiremold/Legrand.
- B. Description:
 - 1. Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
 - 2. Comply with UL 514 scrub water exclusion requirements.
 - 3. Service-Outlet Assembly: Flush type with four simplex receptacles and space for RJ-45 jacks
 - 4. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.
 - 5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 - 6. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.
 - 7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and four-pair cables

2.12 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Color shall be selected by Architect from manufacturer's standard colors unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.
- B. Wall Plate Color: For plastic covers, match device color unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pig-tailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
 2. Install hospital-grade receptacles in patient-care areas with the ground pin at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.
 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 2. Test Instruments: Use instruments that comply with UL 1436.
 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports. Submit reports within two (2) weeks of completion of tests.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600-V ac and less for use in enclosed switches.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.04 INFORMATION SUBMITTALS

- A. Qualification Data: For qualified testing and inspection agency.
- B. Source Quality-Control Reports: Certified test reports shall be signed by manufacturer's testing engineer and include date of manufacture, actual test data, analysis of the tests, name of the testing engineer, location and date of test. Submit with action submittals.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. Include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.
 - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 - 4. Coordination charts and tables and related data.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.07 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Manufacturer shall have ISO 9001 or 9002 Certification.
- C. Manufacturer shall have ability to readily provide replacement parts for a minimum period of ten (10) years, from the date of completion of the project. Furnish a letter from the manufacturer confirming the availability.
- D. Materials shall be new, modern in design and shall not have been in prior service except as required by factory tests. Fuses shall be manufactured within six months of installation.
- E. 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.
- F. Comply with NEMA FU 1 for cartridge fuses.
- G. Comply with CEC.
- H. Comply with UL 248-11 for plug fuses.

1.08 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.09 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.03 PLUG FUSES

- A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.04 PLUG-FUSE ADAPTERS

- A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuse holders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Motor Branch Circuits: Class RK1, time delay.
 - 2. Other Branch Circuits: Class RK1, time delay.
 - 3. Control Circuits: Class CC, fast acting.

3.03 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.
- C. Install spare-fuse cabinet(s).

3.04 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Molded-case switches.
 - 7. Enclosures.

1.03 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. NEMA: National Electrical Manufacturers Association
- D. NETA: InterNational Electrical Testing Association.
- E. OCPD: Over Current Protective Device
- F. SPDT: Single pole, double throw.
- G. UL: Underwriter Laboratories.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Include evidence of UL listing for series rating of installed devices if such devices are specified.
 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
 7. Include ISO certification.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring. Differentiate between manufacturer installed and field installed wiring.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Manufacturer's field service report.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. Include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.08 QUALITY ASSURANCE

- A. American made products have been acceptable to the Owner. If non-domestic products are submitted, notice is hereby given that extensive testing shall be required to insure quality and conformance to the Specifications. Testing shall be done by a recognized lab acceptable to the

Owner and all tests shall be witnessed by Owner's personnel. Testing procedures and test results shall be satisfactory to the Owner. Contractor shall be responsible for arranging the tests, for transportation, food and lodging for minimum of one Owner's representative to witness the test at the testing lab. Include all costs for the above in the bid.

- B. Contractor shall ensure that the manufacturer has a minimum of 15 years experience in the production of switches and circuit breakers similar to the type and size specified in this project.
- C. Manufacturer shall have ISO 9001 Certification.
- D. Manufacturer shall have ability to readily provide replacement parts for a minimum period of ten (10) years, from the date of completion of the project. Furnish a letter from the manufacturer confirming the availability.
- E. Switches and circuit breakers shall be assembled at the manufacturer's own manufacturing facility using its own major components (e.g., trip units) for the assembly. These devices shall be normally carried by the manufacturer as standard catalog items.
- F. Provide certified test reports of shake table test done by manufacturer on similar units.
- G. Materials and equipment shall be new, modern in design and shall not have been in prior service except as required by factory tests. Switches and circuit breakers shall be manufactured within six months of installation.
- H. Source Limitations: Obtain Switches, circuit breakers, overcurrent protective devices, components, and accessories, within same product category, through one source from a single manufacturer through a local distributor unless otherwise noted. All power distribution equipment shall be of the same manufacturer.
- I. Comply with NFPA 70.
- J. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- K. Product Options: Drawings indicate size, profiles, and dimensional requirements of switches and circuit breakers and are based on the specific system indicated. Refer to Part 2 "Product Requirements."
- L. Electrical Components, Devices, and Accessories: UL Listed and labeled as defined in NFPA 70, Article 100 and marked for intended location and application.
- M. Testing Agency Qualifications: Member of NETA;
 - 1. Testing agency shall be an independent company; shall have been a member of NETA for a minimum of last ten (10) years and has permanent in-house testing engineers and technicians involved with testing of OCPDs, switches and breakers similar to those specified on this project.
 - 2. Testing company shall be located with 50 miles radius of the project.
 - 3. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing to supervise on-site testing specified in Part 3.
 - 4. Field Testing technician and supervisor shall have minimum ten (10) years experience in field testing of switches and circuit breakers similar to the type and rating specified on this project.

- N. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switches and circuit breakers including minimum clearances between adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner's Representative and Owner no fewer than fourteen (14) days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's Representative and Owner's written permission.
 - 4. Comply with NFPA 70E.

1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Square D; a brand of Schneider Electric
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Siemens Energy & Automation, Inc.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. HD Switches shall be suitable for systems capable of 200 kA at 480 V with Class J, L, R, or T fusing as indicated for single-throw switches; 100 kA at 600 V for double-throw switches.
- D. Switches shall be padlockable in open or closed position based on application requirements indicated on the drawings.
- E. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.02 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. Square D; a brand of Schneider Electric
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Siemens Energy & Automation, Inc.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Factory installed internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.03 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. Cooper Bussmann, Inc.
 2. Ferraz Shawmut, Inc.
 3. Littelfuse, Inc.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power source of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
 1. Oil-tight key switch for key-to-test function.
 2. Oil-tight red ON pilot light.
 3. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 4. Form C alarm contacts that change state when switch is tripped.
 5. Three-pole, double-throw, fire-safety and alarm relay; verify coil voltage.

6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.04 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 1. Square D; a brand of Schneider Electric
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Siemens Energy & Automation, Inc.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, fully rated with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and below.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Provide for 400A frame size and above. Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 1. Instantaneous trip.
 2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I^2t response. Provide per CEC requirement.
- F. Features and Accessories:
 1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits. Type HACR for Heating, Air Conditioning and Refrigeration loads.
 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.05 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 4X Stainless Steel.
 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X Stainless Steel.
 4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated. Maximum height above finished floor to the center of the grip of device operating handle in its highest position shall be 6'-6" unless lower height is required by code including housekeeping pad.
- B. Comply with mounting and anchoring requirements.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in latest NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection report, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include color scan pictures, notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges

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. 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 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 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 contractor, either due to misinterpretation of this specification or any other conditions of the project, shall be the responsibility of the 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. 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 contractor to deliver a fully functional turn-key system solution that meets intended operational performance requirements.
- H. It is the responsibility of the 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 Contractor as part of the construction process are hereby incorporated into this document by reference. It is the responsibility of the 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 Contractor and shall 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: Contractor shall 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, City Personnel, GC, MEP contractors, structural contractor and all low-voltage 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 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 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 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 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 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. A. Abbreviations and Acronyms:
 - 1. A/E: Architect / Engineer (designer)
 - 2. BICSI: Building Industry Consulting Service International
 - 3. EIA: Electronics Industry Alliance
 - 4. ELFEXT Equal Level far End Cross Talk
 - 5. FTP Foiled Twisted Pair
 - 6. IDF: Intermediate Distribution Facility
 - 7. ILEC/LEC: Incumbent Local Exchange Carrier
 - 8. ISP: Inside Plant
 - 9. IT: Information Technology
 - 10. BDF: Building Distribution Frame
 - 11. LOMMF: Laser Optimized Multi-Mode Fiber
 - 12. MDF: Main Distribution Facility
 - 13. MPOE: Minimum Point of Entry
 - 14. NEXT Near End Cross Talk
 - 15. OSP: Outside Plant
 - 16. PSELFEXT: Power Sum Equal Level Far End Cross Talk
 - 17. PSNEXT: Power Sum Near End Cross Talk
 - 18. RCDD: Registered Communications Distribution Designer
 - 19. TBD: To Be Determined
 - 20. TCIM: Telecommunication Cabling Installation Manual
 - 21. TDMM: Telecommunications Distribution Methods Manual
 - 22. TIA: Telecommunications Industry Association
 - 23. UTP: Unshielded Twisted Pair
 - 24. WAP: Wireless Access Point

1.05 APPLICABLE REGULATORY REFERENCES

- A. 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, 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
- l. 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.
 3. Electric Codes
 - a. California Electrical Code, CEC (2016)
 - 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. 2016 California Title 24
 - a. 2016 California Administrative Code, Title 24 Part 1
 - b. 2016 California Building Code, Title 24 Part 2
 - c. 2016 California Electrical Code, Title 24 Part 3
 - d. 2016 California Mechanical Code, Title 24 Part 4
 - e. 2016 California Plumbing Code, Title 24 Part 5
 - f. 2016 California Energy Code, Title 24 Part 6
 - g. 2016 California Fire Code, Title 24 Part 9
 - h. 2016 Green Building Standard Code, Title 24 part 11
 - i. 2016 California Standard Code, Title 24 Part 12
 6. Local Codes and Standards – all applicable
 7. Avixa (Infocomm)
 8. 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
 - l. Wireless Design Reference Manual, 3rd Edition
 - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
9. 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.
 10. Knowledge and execution of applicable codes is the sole responsibility of the contractor.
 11. Any code violations committed at the time of installation shall be remedied at the contractor's expense.

1.06 SCOPE OF WORK

A. General project information:

1. 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, SGH will be referred to as the owner.
3. Owner wishes to contract with a General Contractor, who will sub-tier the supplier/contractor ("ICT-Information and Communication Technology and AV-Audio Visual") to provide, install, test and warranty a complete turn-key Cable Infrastructure System and Audio-Visual System for Owner's new IVC DSPTS Modular 3300, the "Project" per the scope of work and specifications stated herein. This inquiry implies no obligation on the part of Owner. 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 contractor in preparing and submitting such response.
4. The Owner is developing IVC DSPTS Modular 3300 located in Irvine, CA. IVC DSPTS Modular 3300 will be a newly developed site and will consist of the following:
 - a. (1) level Building.
 - b. IVC DSPTS Modular 3300 - first floor will house the MPOE Room, supporting the IVC DSPTS Modular 3300 network requirements.
5. The scope of work will include a design telecom infrastructure pathways and spaces, and backbone optical fiber and UTP cable distribution. Provide fixed equipment anchorage and bracing details, single line diagrams, equipment and schedules.

B. Purpose:

1. This specification defines quality standards and practices common to all network cabling for the SGH 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".

2. 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 contractor to evaluate these general recommendations and adapt them effectively to actual projects. 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 contractor", these requirements apply equally to anyone doing the network cabling and infrastructure work within, whether those persons are outside contractors or persons directly employed by the owner.
5. 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. Backbone Cabling
 - 1) Interbuilding backbone – Copper and Fiber
 - 2) Patching / Cross-connect – Copper and Fiber
 - 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:

1. 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. Project schedule shall include, but are not limited to, the following task sequence:
 - a. New MPOE Room, Construction and buildout.
 - b. Conduit infrastructure; including vaults/pull box install and conduit duct banks.
 - c. Individual Building Pathway Installation.

- d. Building Category and AV Cable installations; includes install, termination, labeling, testing, as-built and warranty documentation.
- e. Audio Equipment installation.
- f. New backbone fiber optic cabling installations; includes install, termination, labeling, testing, as-built and warranty documentation.
- g. Service provider cabling and equipment installation.
- h. Service provider completion and commissioning.

D. 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 sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

1.07 CONTRACTOR QUALIFICATIONS

A. General:

- 1. Contractor shall have at least 5 years of experience installing and testing structured cabling systems.
- 2. 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. 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 shall be included with quote.
- 5. Contractor shall have service facilities within 50 miles of project location.
- 6. At least 75 percent of the technicians on the job shall 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 shall have a current manufacturer Certified Fiber Technicians certificate to install Fiber Distribution Systems.
- 8. The Telecommunications contractor shall provide a project manager to serve as the single point of contact to manage the installation, speak for the 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 Contractor personnel.
 - c. Ensure conformance with all contract and warranty provisions.
 - d. Participate in weekly site project meetings.
 - e. This individual shall remain project manager for the duration of the project. The contractor may change Project Manager only with the written approval of A/E.

B. References:

1. Communications 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:
1. Contractor shall 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. 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:
1. Owner or A/E reserves the right to terminate the Communication Contractor's services if at any time the A/E determines the Communication Contractor is not fulfilling their responsibilities as defined within this document.
 2. 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 shall strictly be prohibited.
 4. Conduct on project property shall be professional in nature.
 5. Any person in the 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 Contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.
- E. Other Contractor Responsibilities
1. Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job. All work areas shall 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. Contractor shall 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; Contractors shall consider this when placing bids.
 3. 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. 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 shall 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. Contractor Warranty Obligations
1. Installation firm shall be a current manufacturer Certified Installer in good standing and shall include a copy of the company certification with the bid.
 2. 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. 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. Contractor agrees all components comprising active links shall be of the same copper Category or fiber OS/OM designation as the system being installed. Contractor shall under no circumstances mix different Categories or OS/OM classes of cable or termination devices (connectors) within the same link or system.
 5. 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. 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. 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 Contractor shall 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

1. All cabling work being performed on project property or under contract to shall comply with Rules for safe operations, any state or local safety regulations and meet the requirements of OSHA Safety and Health Standards. The contractor Project Manager shall maintain a copy of Rules for Safe Operations for reference. It is the responsibility of the Communications Contractor to immediately correct any unsafe working practices on

- the part of contractor personnel. Unsafe working environments or conditions created by contractor personnel shall be reported immediately to the Construction Manager.
2. Any liability for correction of conditions created by the contractor's personnel rests with the contractor.
 3. The Communications 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 contractor(s) safety measures, in, on, or near the construction site.

1.10 WORKING CONDITIONS

A. Site Access

1. All cable installations shall 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 Contractor shall display badges or passes as mandated by project property Security Department Rules and Regulations.

B. Scheduling

1. Coordination of site surveys and the issue of project owner owned materials and equipment shall be the responsibility of the Construction Manager. Once said equipment and materials are in the contractor's possession, it is the contractors to safeguard the material and equipment from damage or theft.
2. Information required by the Contractor to price and complete a defined scope of work shall be furnished to the Communications Contractor by the A/E Project Manager in a Scope of Work document and at the time of the site survey (if necessary) and shall be maintained by the Communications Contractor until the completion of the job.
3. It is the 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 Contractor shall 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 Contractor shall coordinate with the Construction Manager working hours and job site access issues.
6. The Communications Contractor shall coordinate with the Construction Manager to minimize outages to the existing systems.
7. Any service interruption required by the Communications Contractor shall be requested in writing and scheduled with the Construction Manager.
8. The Communications 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, shall be referred to the Construction Manager and no changes shall be made without his/her written approval.

C. Harmony Clause

1. 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 owner contractors and equipment suppliers.
 1. Meet jointly with other contractors, equipment suppliers, and owner 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, 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.
 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. Contractor shall provide product data and installation instructions for all fire stopping materials
 4. Alternate and "Or Equal" designated products shall be submitted for review and judgment to the A/E prior to installation. The contractor proposed alternate products or components shall 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.
 5. Any request of an alternate or substitution shall 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. 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 contractor. ICT 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 contractor. There shall be no additional cost incurred by SGH project for not complying with the specifications and requirements of the Contract Documents.

- B. B. Any variance from those components identified on the drawings and/or below shall be submitted to Ware Malcomb project representatives for approval prior to ordering and installation; the risk for all costs incurred by the ICT Contractor for materials ordered prior to such written approval shall be borne entirely by the ICT contractor. Nonetheless, it is imperative that the ICT 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 Contractor shall verify all part numbers prior to ordering materials. Clarifications shall be issued in response to written Requests for Information (RFI).
- C. Fire Stop and firestopping requirements for the project include:
 - 1. All conduits leaving the entrance room for other portions of the building shall be fire-stopped after the installation of cable.
 - 2. The Contractor shall fire stop around the tray and, after installation of the cables, within the tray using removable pillow-style products following manufacturers' guidelines. Sound deadening material shall be provided and installed after installation of cable.
 - 3. Strict adherence to the CEC/NEC NFPA 101 is required for any raceway penetrations of fire-rated walls. See section 07840 for UL system numbers and to construction drawings for details.
 - 4. All riser conduits shall be sealed using a UL classified fire stop. The Contractor shall provide a copy of the fire seal manufacturer's installation instructions and rating information prior to inspection of the installed materials.
 - 5. Integrally Fire Stopped Sleeves
 - a. Integrally Fire Stopped Sleeves shall be used for Telecommunications cabling in locations where the cabling pathway penetrates a fire barrier. The IFSS shall replace the use of conduit used in conjunction with other fire stopping methods.
 - b. All manufacture instructions and requirements shall be followed for the installation of the IFSS.
 - c. Documentation shall include picture of completed assemble with time/date stamp.
- D. All new fiber optic cabling, shall be indoor/outdoor-Plenum rated. Unrated cable (such as filled ASP) shall not be installed within the structure except when placed within IMT, PVC or RGS conduit.
- E. Throughout this specification, **Corning, Superior Essex, Chatsworth Products, Inc.** and other manufacturers are cited. These citations are for the purpose of establishing quality, performance and warranty certification criteria.

1.14 DELIVERY AND STORAGE

- A. ICT 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 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:
1. The 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.
 - a. The drawing notes shall define field conditions experienced not defined in sheet notes.
 - b. The drawings shall identify all fire stop locations and digital picture shall accompany as-built package.
 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 contractor to print, frame and mount approved as-built drawings in MPOE. Coordinate location with A/E.

1.17 QUALITY ASSURANCE

- A. Qualifications – Manufacturer
1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.
 2. Installers shall have manufacturer certificate of completion for the fire stop solution being proposed.
- B. Qualifications – Installer:

1. At a minimum, seventy-five percent (75%) of the onsite 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.
- B. Methodology for fire stop requirements that contractor shall comply with, include:
 1. In any area in which a fire rated wall, partition, floor, or ceiling is penetrated, the Contractor shall be responsible for creating the pathway and sealing around all cables and sleeves with a UL classified fire seal sufficient to return the structure to its original rating. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor. Any opening in a rated structure created by the Contractor that is larger than one inch in diameter shall be equipped with a metal sleeve secured and fire-stopped in place.
 2. Comply with requirements in Section 078413 "Penetration Firestopping." (Check Architect specifications for fire stopping)
 3. Comply with TIA-569-B, Annex A, "Firestopping."
 4. Comply with BICSI TDMM, "Firestopping Systems" Article.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall, so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 4 inches above finished floor level. Install sleeves during erection of floors.

- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

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. 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. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 05 26
GROUNDING BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Specifications for grounding and bonding components utilized to provide proper grounding and bonding for telecommunications cabinets, racks, cable tray, ladder tray, cable and equipment.
 - 2. Grounding and bonding components with design criteria.

1.02 RELATED DOCUMENTS

- A. Section 270500 and 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 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:

1.04 QUALITY ASSURANCE

- A. Qualifications – Manufacturer
 - 1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.
- B. Qualifications – Installer:
 - 1. 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

- 1. 2.1 GROUNDING AND BONDING
 - B. Basis-of-Design Product: Subject to compliance with requirements, provide manufacturer or comparable product by one of the following:

1. CPI
 2. B-Line
 3. Circa
 4. Or Equal
- C. Product Options:
1. The indicated manufacturers shall be the basis of the design and each component selected shall address the infrastructure requirement.
- D. Description:
1. Sub-contractor is responsible for bonding to ground all newly placed equipment and installed racks or cabinets per the TIA 607-B Standard.
 2. EXECUTION

2.02 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.

2.03 INSTALLATION

- A. Process:
1. All newly installed racks and cabinets shall have installed a vertical busbar mounted along one equipment rail to serve as a clean, low-resistance bonding place for any equipment not equipped with a designated grounding pad.
 2. Smaller equipment without an integrated grounding pad shall be bonded to the vertical busbar using a thread-forming grounding screw that is anodized green and includes serrations under the head to cut through oxidation or paint on the equipment flange.
 3. Larger equipment (chassis switches) with a designated grounding terminal shall be bonded to the vertical busbar with an EBC (equipment bonding conductor) kit built to that purpose.
 4. All grounding wire shall be a minimum #6 AWG stranded annealed ground wire, PVC sheathed with nylon. Meets UL83 for THHN or THWN and UL1063.
 5. All OSP cabling terminated within new campus MDF shall be terminated to a Building Entrance Terminal with gas fuses.
 6. Sub-contractor shall take care to clean (wire brush, scotchbrite pads) any metallic surface to be bonded down to bare metal and apply a film of anti-oxidation paste to the surfaces prior to effecting the bond.
 7. All bonding lugs on racks and busbars shall be of two-hole irreversible compression type. Mechanical lugs and single-hole lugs will not be accepted and shall be removed and replaced at Sub-contractor's expense.
 8. Every rack or cabinet shall have an individual bonding conductor into the grounding network. Serially connecting (daisy-chaining) of racks is expressly forbidden and will not be accepted.
 9. Rack Bonding Conductors (RBC) may tap into an overhead or underfloor aisle ground, or may run to the wall-mounted grounding busbar in smaller Telecommunications rooms containing 5 racks or less.

10. Armored cables shall be properly bonded to the earthing system with a kit built to that purpose.
11. All metallic conduit stub-ups shall be grounded, and where multiple stub-ups are made within an equipment enclosure, they shall be equipped with grounding bushings and bonded together and to the enclosure and the enclosure ground bus.
12. Each metallic raceway, pipe, duct and other metal object entering the buildings shall be bonded together. The Sub-contractor shall use #6 AWG green insulated copper conductors.
13. Each identified telecommunications space within a building shall have a common signal reference ground. The signal reference ground shall conform to the following:
 - a. Within the building, all communication spaces shall be separately bonded to each other and connected to the primary building ground in accordance with the provisions of EIA/TIA 607. The communication ground shall not ground any other equipment or be connected to any potential high voltage source. All racks, frames, drain wires, and all installed communication equipment shall only be grounded to this common reference ground with a minimum size #6 AWG green insulated copper wire.
 - b. The Sub-contractor shall provide, as a minimum, a continuous #3/0 AWG copper electrical conductor connected to a 1/4" x 4" x 12" telecommunications grounding bus bar (TGB) 6" AFF on the plywood backboard of each IDF (or telecommunication space) to terminate chassis and other equipment grounds.
 - c. The ground wires from each individual IDF shall be routed directly to the Building Distribution Frame (BDF), terminated and bonded together via a telecommunications main grounding bus bar (TMGB) of minimum 1/4" x 4" x 20" dimensions. This point of single reference for all closets in a building shall in turn be grounded with a minimum #3/0 AWG ground conductor to the main building ground. If a main building ground is unavailable, the ground wire from the BDF shall be grounded to the nearest electrical panel ground bus bar. The building ground for signal reference shall be the building service entrance ground.
14. Ground Bus Bar Identification.
 - a. The master ground bar shall be labeled as such.
 - b. Each subsidiary ground bar shall be labeled as such and have a unique identifier.
 - c. All ground bars shall have a warning label that states, "If this connector or cable is loose or shall be removed, please call the Telecommunications Manager." All ground bars will be connected to the building ground with continuous "3/0" AWG wire.
 - d. Each ground cable shall be labeled with a unique identifier.

2.04 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

2.05 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 29
HANGER AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Provides specifications for non-continuous cable support components utilized to provide pathways support to telecommunications cables traveling outside cable trays, conduits, or other continuous cable supports.
 - 2. Non-continuous cable supports.

1.02 RELATED DOCUMENTS

- A. Section 270500 and 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. Anywhere cabling Standards conflict with electrical or safety Codes, Sub-contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
 - 2. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
 - 3. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

1.03 QUALITY ASSURANCE

- A. Qualifications – Manufacturer
 - 1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.
- B. Qualifications – Installer:
 - 1. 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.

1.04 WARRANTY

- A. Warranty:
 - 1. Sub-contractor shall provide a 25 year System Warranty on all copper and fiber permanent cabling links.

2. This is a system performance warranty guaranteeing for 25 years from acceptance that the installed system shall support all data link protocols for which that copper Category or fiber OM/OS designation is engineered to support according to IEEE and TIA standards.
3. The System Warranty may be invoked only if the cabling channel links are comprised of approved cable infrastructure connectivity and approved cable. Patch cords must be manufactured by same approved cable and/or connectivity system.
4. Upon acceptance of Warranty, manufacturer will mail a notification letter to the installer and a notification letter and warranty certificate to A/E.

PART 2 PRODUCTS

2.01 NON-CONTINUOUS CABLE SUPPORTS

- A. Basis-of-Design Product: Subject to compliance with requirements:
 1. Erico – Caddy CableCat Support System
 2. Copper/BLine – Cable Hook System
 3. CEAS Attachments – Stiffy Series
 4. Panduit – Jmod Cable Support System
 5. 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 requirement.
 - a. Stiffy Series 200 with comfort cradle Low Voltage supports
 - b. Four inch (0'4") Cat214z34, two inch (0'2") J-Hook Supports Cat324z34
- C. Description:
 1. Non-continuous cable supports shall be available in multiple sizes, styles and materials. Rigid supports shall be equipped with flared edges and pre-configured bend radius controls.
 2. Provide drop wire supports and threaded rod assemblies in areas where structural mounting surfaces are non-functional or inaccessible.
 3. Support assemblies shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance UTP and optical fiber cables.
 4. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be reusable.
 5. Select approved non-continuous cable supports suitable for specific installation environments and/or air handling (plenum) spaces.

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. Process:

1. Follow manufacturer's instructions and recommended industry standards and guidelines.
2. The installed non-continuous support system must be an independent support structure for the voice/data communication system.
3. Draping cables over other structures in the ceiling is unacceptable. Water pipes, ceiling grid, sprinkler system, electrical supports, air ducts or any other in-ceiling structure may not be used for cable support.
4. Sub-contractor installed supports shall be used to supplement the main cable support system when any cabling leaves the main support system or is unsupported for more than three and one half feet (3'-5'-0") feet.
5. Non-continuous supports shall be installed with rod stock or threaded rod secured to the slab above to support the telecommunications cable infrastructure parallel to the slab throughout the cable plant, unless site conditions dictate a non-parallel installation.
6. Cable must be routed to follow existing corridors and parallel or 90 degree angles from all walls and the cable tray whenever possible.
7. Communication EMT conduit sleeves shall receive conduit waterfall to control bend radius of the communication cable to a minimum of a 4" radius.
8. All pathways shall avoid electromagnetic interference (EMI). Cable that is distributed in partially-enclosed metallic pathways shall be routed with the following minimum clearances:
 - a. Four (4) feet from motors or transformers.
 - b. One (1) foot from conduit and cables used for electrical power and distribution.
 - c. Five (5) inches from fluorescent lighting.

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 05 33
CONDUITS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. 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.

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. Thomas & Betts
 - 2. Hubbell Raco

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. Communication EMT conduit sleeves shall receive conduit waterfall to control bend radius of the communication cable to a minimum of a 4" radius.
- C. 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.
- D. Supporting devices: U channel trapeze assemblies, 1/2" Threaded rods, clamps, conduit straps, C-clamps and retainers.
- E. Fasteners: 3/8" Carbon steel expansion anchors with 2 1/2" embed into concrete slab for pull box U-channel support attachment to concrete slab. The anchors must be tested and approved under dual load conditions: Hilti Kwikbolt 3, Ramset/Redhead Trubolt. Or equal.
- F. U-channel systems: 16 gauge steel channels. Provide fittings and accessories that match with the U-channel of the same manufacturer.

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, marked, hinged access panel (or equivalent) in the ceiling. This access panel can also serve as the cover for the box.
 - 6. Install conduit radius waterfall for all EMT conduit sleeves entering telecommunication room or through main pathway fire rated walls, quantity as shown on drawings.
 - 7. Pull box sizing table:

B. Back Boxes

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

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.
5. 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.

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. Communication EMT conduit sleeves shall receive conduit waterfall to control bend radius of the communication cable to a minimum of a 4" radius.
9. 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.
10. Contain no continuous sections longer than 100 ft.
11. 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.
12. Withstand the environment to which they will be exposed.
13. 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.
14. 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.

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 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Section 270500 and 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.

1.02 SUMMARY

- A. Section Includes:
 - 1. Ladder cable trays.
 - 2. Wire-basket cable trays.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of cable tray.
 - 1. Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
 - 1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings. Drawings to match same scale as approved design or construction drawing set.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
 - 2. Vertical and horizontal offsets and transitions.
 - 3. Clearances for access above and to side of cable trays.
 - 4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.
- B. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
 2. Component Importance Factor: 1.5.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in 2016 CEC Article 392 and marked for intended location, application, and bonding per Article 800.100/A/1-6.
1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Sizes and Configurations: See drawings for specific requirements for types, materials, sizes, and configurations.
- C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
 2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
 3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.03 LADDER CABLE TRAYS (LADDER RACKING)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper B-Line, Inc.
 2. Chatsworth Products Inc.
 3. Hoffman Pentair
- B. Description:
1. Configuration: Two 1-1/2" x 3/8" 16-gauge tubular steel side rails with transverse rungs welded to side rails.
 2. Rung Spacing: 9 inches O.C.
 3. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
 4. Minimum Cable-Bearing Surface for Rungs: 1-inch width with radius edges.

5. No portion of the rungs shall protrude below the bottom plane of side rails.
6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1, Section 5.4.
7. Straight Section Lengths: 9 feet 11.5 inches except where shorter lengths are required to facilitate tray assembly.
8. Width: 12 inches unless otherwise indicated on Drawings.
9. Fitting Minimum Radius: 12 inches.
10. Splicing Assemblies: Bolted type using serrated flange locknuts.
11. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.04 WIRE-BASKET CABLE TRAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Cablofil/Legrand.
 2. Cooper B-Line, Inc.
 3. Snaketray.
 4. Chatsworth Products Inc.
- B. Description:
 1. Configuration: Wires are formed into a standard 2-by-4-inch wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
 2. Materials: High-strength-steel longitudinal wires with no bends.
 3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
 4. Sizes:
 - a. Straight sections shall be furnished in standard 10 feet lengths.
 - b. Wire-Basket Depth: 2-inch usable loading depth by 4 inches to 24 inches wide.
 - c. Wire-Basket Depth: 4-inch usable loading depth by 4 inches to 24 inches wide.
 - d. Wire-Basket Depth: 6-inch usable loading depth by 8 inches to 24 inches wide.
 5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
 6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
 7. Hardware and Fasteners: Steel, zinc plated according to ASTM B 633.

2.05 MATERIALS AND FINISHES

- A. Steel:
 1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1008/A 1008M, Grade 33, Type 2.
 2. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.

3. Finish: Mill galvanized before fabrication.
 - a. Standard: Comply with ASTM A 653SS/A 653M, G90.
 - b. Hardware: Chromium-zinc plated, ASTM F 1136.
 4. Finish: Electrogalvanized before fabrication.
 - a. Standard: Comply with ASTM B 633SS.
 - b. Hardware: Galvanized, ASTM B 633SS.
 5. Finish: Hot-dip galvanized after fabrication.
 - a. Standard: Comply with ASTM A 123/A 123M, Class B2/ASTM A1008, Grade 33, Type 2.
 - b. Hardware: Chromium-zinc plated, ASTM F 1136.
 6. Finish: Powder-coat enamel paint.
 - a. Powder-Coat Enamel: Cable tray manufacturer's recommended primer and corrosion-inhibiting treatment, with factory-applied powder-coat paint.
 - b. Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
 - c. Epoxy-Resin Topcoat: Epoxy, cold-cured, gloss, MPI# 77.
 - d. Hardware: Chromium-zinc plated, ASTM F 1136.
 7. Finish: Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware according to ASTM F 1136.
 8. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.
- B. Aluminum:
1. Materials: Alloy 6063-T6 according to ANSI H 35.1/H 35.1M for extruded components and Alloy 6061-T6 according to ANSI H 35.1/H 35.1M for fabricated parts.
 2. Hardware: Chromium-zinc-plated steel, ASTM F 1136.

2.06 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.07 WARNING SIGNS

- A. Lettering: 1-1/2-inch high, black letters on yellow background with legend "Warning! Not to Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
- B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

2.08 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA VE 1.

PART 3 EXECUTION

3.01 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Remove burrs and sharp edges from cable trays.
- E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.
- F. Fasten cable tray supports to building structure and install seismic restraints.
- G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems." Comply with seismic-restraint details according to Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- J. Support bus assembly to prevent twisting from eccentric loading.
- K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.
- M. Support wire-basket cable trays with center support hangers, trapeze hangers, or wall brackets as noted on construction drawings.
- N. Support center support hangers and trapeze hangers for wire-basket trays with 3/8-inch-diameter rods.
- O. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- P. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.
- Q. Make changes in direction and elevation using manufacturer's recommended fittings.
- R. Make cable tray connections using manufacturer's recommended fittings.
- S. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."

- T. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- U. Install cable trays with enough workspace to permit access for installing cables.
- V. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
- W. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.
- X. Clamp covers on cable trays installed outdoors with heavy-duty clamps.
- Y. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.02 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in ANSI/NECA/BICSI-607, ITSM-2017, and Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Cable trays with control conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.
- E. Bond cable trays to power source for cables contained within with bonding conductors sized according to ANSI/NECA/BICSI-607, ITSM-2017, and Section 260526 "Grounding and Bonding for Electrical Systems."

3.03 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. Fasten cables on vertical runs to cable trays every 18 inches.
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.
- E. Tie MI cables down every 36 inches where required to provide a 2-hour fire rating and every 72 inches elsewhere.
- F. In existing construction, remove inactive or dead cables from cable trays.

3.04 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
 - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
 - 4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
 - 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
 - 6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
 - 7. Check for improperly sized or installed bonding jumpers.
 - 8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
 - 9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.
- B. Prepare test and inspection reports.

3.06 PROTECTION

- A. Protect installed cable trays and cables.
 - 1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
 - 2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
 - 3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION

SECTION 27 05 43
UNDERGROUND DUCTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Publications and Standards
- B. Work Sequencing and Coordination
- C. Telecommunications Submittals
- D. Quality Assurance

1.02 PUBLICATIONS AND STANDARDS

- A. National Electrical Code (NEC) (ANSI/NFPA 70):
 - 1. Chapter 8: "Communications Systems"
 - 2. Article 250: "Grounding"
- B. Telecommunications Industry Association TIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
- C. Federal Communications Commission (FCC) Part 15 and Part 68
- D. Rural Utilities Services (RUS), formally REA
- E. Lightning Protection Code - ANSI/NFPA 780-2017
- F. American Society for Testing Materials (ASTM) Publications
- G. National Electrical Manufacturer's Association (NEMA) Publications
- H. State of California Administrative Code, Title 24, Part 3, CCR, 1994 California Electrical Code
- I. State of California Public Utilities Commission (Cal. P.U.C.) Publication: G.O. 92, 95, & 128 Rules for Construction of Underground Electrical and Communications Systems
- J. Underwriters Laboratories Inc. (U.L.) Publications
 - 1. 6-1981 (R86) Rigid Metallic Conduit
 - 2. 514B-1982 Fittings for Conduit and outlet Boxes
 - 3. 651-1981 Schedule 40 and 80 Rigid PVC Conduit
 - 4. UL 467 "Grounding and Bonding Equipment"
 - 5. UL 497, 497A, and 497B "Communications Circuit Protectors"

1.03 RELATED SECTIONS

- A. Contract Terms and Conditions
- B. Division 1 specification sections
- C. Division 26 Related Electrical Underground Section(s)
- D. Division 26 Related Bonding and Earthing Section(s)

1.04 SUBMITTALS

- A. Submittals shall be made as defined in Section 270500.

1.05 QUALITY ASSURANCE

- A. For products or workmanship specified by association, trade, Federal, or State Standards, the Contractor shall comply with the requirements of the standard. When more rigid requirements are specified or required by applicable (City) codes, the Contractor shall comply with City codes and local AHJ requirements.
- B. The Contractor shall conform to reference standard by date of issue current on final design documents.

PART 2 PRODUCTS

2.01 COMMUNICATIONS UTILITY VAULTS

- A. All telecommunications vaults to be placed shall be specifically designed for telecommunications applications, with no exceptions.
- B. Materials
 - 1. The Contractor shall provide pre-cast utility vaults meeting ASTM C 478 with 28-day 5500 psi minimum compressive strength concrete and designed for AASHTO H-20 loading per AASHTO HB 14. The dimensions for each utility vault are specified on the construction drawings. Any questions the Contractor has about the size should be discussed with the owner's representative and the telecommunications engineer.
 - 2. Utility vaults shall have tongue-and-groove double sealed joints on mating edges of pre-cast components. The joints shall firmly interlock adjoining components and provide waterproof junctions and adequate shear transfer. Joints shall be sealed with approved watertight joint sealant as prescribed in the manufacturer's installation specifications and conforming to AASHTO M198, Type B. Sealing material shall be installed in strict accordance with manufacturer's printed instructions.
 - 3. Conduit Entrances
 - a. Knockout panels or pre-cast individual conduit openings may be used.
 - b. On sides where no conduit is installed, 12-inch high by 12-inch wide (minimum) knockout panels for future raceway installation shall be provided. Knockouts are required on all four sides.
 - c. For existing utility vaults, new ducts shall enter the utility vault with factory-formed bell end of the conduit, and a seal around the conduit shall be applied after installation. Existing utility vaults shall be retrofitted with the required racking and grounding and bonding per the TIA Bonding and Grounding Standards.
 - 4. Covers
 - a. The Contractor shall provide solid covers (traffic rated), with a 76.2 cm (30 in.) diameter clear opening. For vaults longer than 12' in length, (2) openings with covers are required.
 - b. Heavy-duty type frames and covers made of cast iron 10" high, suitable for H-20 loading, and having machined bearing surfaces shall be used.
 - c. The covers shall be of indented type with solid top design.

- d. The upper side of each cover shall have the letters "Communications" cast or burned by welder, in integral letters no less than 2 inches high. Either the covers or the ring of the casting shall be field stamped with utility vault or pull box numbers.

C. Manufacturers

1. Utility Vault Company (Old Castle)
2. Jensen Precast
3. Approved equivalent product

2.02 COMMUNICATIONS PULL BOXES

- A. Pre-cast pull boxes shall meet the standards defined in Subsection 2.1.B.(1).
- B. Joints and seals shall be provided and installed as defined in Subsection 2.1.B.(2).
- C. Conduit entrances shall be provided as defined in Subsection 2.1.B.(3).
- D. Pull boxes shall be equipped with cable racking on both long walls suitable to support large copper cables as called for on the design documents.
- E. All pull boxes shall be equipped with spring-loaded, traffic-rated, skid proof lids with a locking mechanism, unless otherwise specified in the drawings. All lids shall have the identification marking of "Communications" permanently affixed to the cover. The pull box number identification shall be stamped or welded on the cover per the Owner's specified numbering plan.

2.03 COMMUNICATIONS UTILITY VAULT/PULL BOX HARDWARE

A. Materials

1. Pulling irons shall be provided, as required for the size of utility vault/pull box (minimum of 4 per utility vault: 2 placed on each end wall, top and bottom). Pulling irons shall be placed opposite the terminators. All pulling irons shall be constructed of 2.2 cm (7/8 inch) hot-dip galvanized steel.
2. A sump of 30cm (12 in.) in diameter shall be provided in each utility vault, per the manufacturer's specifications.
3. Heavy-weight cable racks with adjustable arms shall be provided for all cables in each utility vault. The racks shall be attached with adjustable inserts set in the concrete walls (bolts or studs embedded in concrete will not be used). Racks and inserts shall be centered on the side walls that are utilized for the racking of splice cases in the utility vault, arranged so that all spare conduit ends are clear for future cable installation. The racks shall have a sufficient number of arms to accommodate cables for each conduit entering or leaving the utility vault.
4. Corner stand-off brackets 15cm to 20cm (6 in. to 8 in. from wall) shall be provided if the utility vault is equipped with center exit conduits. The bracket shall extend from 15cm (6 in.) off floor to 15cm (6 in.) below roof.
5. All utility vault and pull box hardware shall be steel that is hot dip galvanized after fabrication.
6. Each utility vault shall have a detachable galvanized steel ladder that can be removed to facilitate future work in the utility vault. The ladder shall be secured to a top support arm in the utility vault opening or chimney.

B. Manufacturers

1. Hardware: Alhambra Foundry (model No. A-3382 ladder with A-3383 support bar) or Inwesco Products, or an approved equivalent product.
2. Utility vault: Utility Vault, or Associated Concrete Products, or an approved equivalent product.

C. Materials

1. Conduit
 - a. Schedule 40 PVC - 4 inch inside diameter.
 - b. Type C telephone conduit - 4 inch inside diameter (if concrete encased).
 - c. If directional boring: HDPE Conduit, 4" from Carlon or equal.
 - d. Corrugated flexible orange inner duct, 1-inch ID diameter, will be placed for fiber optic cable protection. A minimum of 4 inner ducts shall be placed in a 4-inch conduit, unless otherwise directed in the drawings.
2. Conduit shall have a factory formed bell on one end for interconnecting segments.
3. Spacers: High impact spacers shall be used in all multi-duct systems, for both solely-owned or joint telecommunications/power construction. They shall conform with NEMA TC-2, TC-6, TC-8, and ASTM F 512 dimensions.
4. All fittings shall be designed specifically for use with the type of conduit placed.
5. All conduits shall be equipped with seal plugs in all utility vaults/pull boxes and expansion rubber seal plugs within all buildings.
6. Manufacturer: CARLON or approved equivalent.

2.04 COMMUNICATIONS ENTRANCE CONDUIT

- A. To prevent shear, all conduit entering a building shall transition from PVC to metal from a minimum distance of 24" beyond the exterior of the foundation. These conduits shall slope downward away from the building to reduce the potential of water entering the building.

2.05 DUCT-BANK LOCATING CABLE (DETECTABLE WARNING TAPE)

- A. Warning tape shall be a minimum of 3" wide, orange in color, and shall have a nondegradable imprint as follows:
 1. "Caution Joint Power and Telecom Cable Buried Below"
- B. The tape shall be detectable.
- C. Manufacturer:
 1. Carlon
 2. Approved equivalent product

2.06 PULL ROPE

- A. Pull rope shall be new 1/4" polypropylene over polyester rope with a minimum 1700 lb. tensile strength or woven cotton cord with footage markings (mule tape).
- B. Manufacturers: Carlon or approved equivalent.

2.07 BONDING/GROUNDING – VAULTS AND PULL BOXES

- A. The reinforcing steel in the walls of the utility vault shall be bonded together and brazed to the bronze inserts of each section of the utility vault per the manufacturer's utility vault specifications. Two ground rods at opposite corners shall be furnished and installed in each vault (one rod in vaults smaller than 3' X 5' X 4'). The ground inserts shall be attached to the steel rebar to provide a point of attachment for the ground wires or bonding ribbon. The inserts shall be bronze, flush mounted, and brazed (exothermic weld) to the rebar cage of all the sections of the utility vault (bottom, intermediate, and roof sections).
- B. Materials
 - 1. Bonding Ribbon: Shall be made of annealed solid copper 3/8-inch-wide x 1/16 inch thick, tin plated. Manufacturer: INWESCO Cat.12A55 or approved equivalent.
 - 2. Bonding Ribbon Clamp: Shall be made of soft lead 1/2-inch-wide by 1/16-inch-thick and shall accept 1/4-inch diameter bolt. Manufacturer: INWESCO Cat. 12A56 or approved equivalent.
 - 3. Fargo Clamp: Shall be cast from copper, silver plated, furnished with copper bolt. Manufacturer: INWESCO Cat.12A57 or approved equivalent.
 - 4. Ground Rod: Shall be manufactured of high strength high carbon steel, with electrolytically bonded jacket of copper on surface, and shall meet UL spec. 467 and ANSI C-33.8-1072. Manufacturer: INWESCO Cat.12A60 or approved equivalent.
 - 5. Ground Inserts: Shall be made of Cast Bronze W/1/4 Copper Rod. Manufacturer: INWESCO Cat.12H69 or approved equivalent.

2.08 RACEWAY TAGS

- A. Permanent markers with raceway designations engraved onto the tag shall be provided. Tags relying on adhesives or taped-on markers shall not be used.

2.09 DUCT PLUGS

- A. Provide duct plugs capping all empty conduit and at conduit with installed cabling. All ducts and duct plugs must be re-enterable.

PART 3 EXECUTION

3.01 COMMUNICATIONS UTILITY VAULTS AND PULL BOXES

- A. General
 - 1. The Contractor shall obtain all required permits and notifications before commencing any work operations.
 - 2. All state and local ordinances shall be complied with at all times.
 - 3. All federal, state, and local safety rules, including OSHA, will be enforced at all times during the duration of the project. It is the responsibility of the Contractor to inspect the job site to ensure compliance.
- B. Final location of all communications utility vaults and pull boxes shall be determined by the Contractor and owner's representative.

- C. All conduits entering a utility vault or pull box shall be placed at right angles to the short walls and shall be sealed to prevent seepage unless otherwise specified on the construction documents.
- D. Excavation dimensions shall be verified with the utility vault supplier in advance so as to prevent delays in setting schedule. All utility vaults and pull boxes shall be placed on 12 inches of compacted bedding material.
- E. Shoring shall be in accordance to prevailing underground construction codes, i.e., OSHA, G. O. 128, NESC, and all applicable local, state, and federal statutes.
- F. All utility vaults shall be equipped with pulling irons and a ladder for access.
- G. Finish grade shall be established prior to placing structures.
- H. The Contractor and the owner's representative shall inspect all utility vaults prior to backfilling.
- I. Backfill materials shall have been sifted to provide a sand equivalent of not less than 20, and a sieve size of No.4 Backfill material shall be mechanically compacted to a minimum relative compaction of 90 percent to a level six (6) inches above final grade. The excess material shall be excavated to the final grade upon acceptance of compaction.
- J. Existing and/or new communications utility vaults/pull boxes may be placed near the existing power and signal vault system. The Contractor shall either place new or enlarge existing utility vaults/pull boxes and conduits in such a manner as to not disturb existing utilities while maintaining specified clearances from all obstructions. This may require clearing much of the area around the vaults by hand. The final placement and depth shall be determined by the Contractor and owner's representative.
- K. The Contractor shall locate all existing utilities within 20 feet of the new and/or enlarged utility vault/pull box system. The Contractor and owner's representative shall review and approve any revised coordination schematics. Caution shall be used when working in this area.
- L. The Contractor shall excavate around existing vaults using caution to identify and preserve all utilities in the area.

3.02 UTILITY VAULT COVERS AND HARDWARE

- A. Pull boxes shall be equipped with a non-skid, spring-loaded traffic-capable lid with a locking mechanism.

3.03 DUCT BANKS AND CONDUITS

- A. All communications conduit banks shall be encased in slurry (2 bag cement mix, minimum 1800 PSI) with at least 2 inches of concrete at the top and bottom and 2 inches on each side when deemed necessary based on one or more of the following: bending radius, weight bearing, mechanical stress, etc. A horizontal and vertical separation of 2 inches between the ducts shall be maintained by installing high impact spacers with horizontal and vertical locking intervals of ten feet. Concrete shall have ten pounds of red oxide added for color.
- B. All communications conduit shall be placed in a uniform manner between vaults. Conduit in position #1 at one utility vault shall maintain its position within the duct run and terminate in

the #1 position at the next utility vault. The position of all conduits between utility vaults shall be maintained. All conduits shall enter utility vaults using the lower most precast knockouts.

- C. Long radius bends (over 40 feet) shall be used whenever possible to make changes in direction. If it is found to be necessary to place a 90-degree bend in the conduit run, a factory-made sweep of no less than 12' 6" radius shall be used. No conduit run shall exceed a total of 180 degrees of bend between any two points (such as utility vaults or buildings) considering both vertical and horizontal sweeps. Cold formed trench bends shall have a radius of not less than 40 feet and shall pass mandrel integrity. Bend radius criteria for conduit size 2" or less is 6 times the diameter of the conduit and, for any conduit larger than 2", 10 times the diameter of the conduit.
- D. All bends of less than 20-foot radius shall be encased in concrete when using Type C or Schedule 40 PVC conduits. Encasement shall start from 2 feet before curve to 2 feet past curve. Concrete shall be Type B at 2500 PSI, aggregate of no more than ¾" minus. Conduits shall be spaced at 2 inches minimum using high impact spacers at 2 feet on center.
- E. The length and destination of all conduits shall be identified in each utility vault, pull box, and building. Embossed metal tags identifying each conduit shall be placed on end walls.
- F. After installation of communications conduit, the Contractor shall prove all conduits by pulling a mandrel with a diameter ¼ inch smaller than the conduit and 6 inches long through each conduit end-to-end. An inspector designated by the Contractor and the owner's representative shall be notified 24 hours before this procedure. Each conduit shall be cleaned with a bristle brush to remove any debris.
- G. All utility vault and pull box entrances shall be shear-blocked with standard concrete extending no less than 15 inches from the entry wall. All entering ducts shall be completely encased.
- H. Utility marking tape (see 3.5.A) shall be buried 12 inches below the surface directly above the conduit.
- I. All conduit structures shall be built with the telecommunications conduits placed above the power conduits unless otherwise called out on the construction drawings and approved by the campus. If this type of construction is required, it shall receive the prior approval of the Contractor, the owner's representative, and the Local Exchange Carrier.
- J. All entrance conduits shall be securely fastened to the building. The end of the conduit located inside the building shall be sealed with expandable solid plugs to prevent rodents, water, or gases from entering the building.

3.04 ENTRANCE CONDUIT

- A. The Contractor and the owner's representative shall determine the placement of all entrance conduit. All Applicable standards shall be adhered to, i.e., NEC, BICSI, Western Electric OSP, NESC or G.O. 128.

3.05 LOCATING DUCT BANK CABLE

- A. Underground detectable warning tape shall be placed in all trenches at one foot below the final grade after the conduit and encasement is complete. The tape shall indicate the type of cable that will utilize the substructure system, e.g., fiber optic or copper cables. The

detectable warning tape shall be installed according to manufacturer's specifications to ensure access to the tape for locating purposes.

3.06 PULL ROPE

- A. Pull rope shall be new material that is free of knots, kinks, and abrasions.
- B. Pull rope shall be placed as a single continuous length in every new duct section. (See Section 16730, 2.7.)
- C. Pull rope shall be secured at each end.

3.07 BONDING/GROUNDING

- A. Two ground rods shall be installed in each new manhole and one rod in a new pull box. All noncurrent-carrying metal parts in the utility vault and any metallic raceway grounding bushing shall be connected to this ground rod with a No. 4/0 bare copper ground conductor and approved ground clamp, as required per NEC.
- B. The grounding system shall not rely on plumbing systems.
- C. Bonding conductors shall be routed with a minimum number of bends. The bends placed in the conductor should be sweeping.
- D. All bonding connections shall utilize listed bolts, crimp pressure connectors, clamps, or lugs. Exothermic welding may be used.
- E. Multiple bus bars shall be directly bonded together with a No. 4/0 copper conductor.
- F. Backbone cabling shall be bonded at each sheath opening with, minimally, a 6-AWG copper conductor.

END OF SECTION

SECTION 27 15 13
COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Provides specifications for four-pair UTP copper horizontal workstation cabling to distribute network signals from telecommunications distribution spaces to work area outlet locations.
 - 2. Category 6A CMP rated, Four-Pair Copper Cabling.
 - 3. RG6 Coaxial CMP rated Cabling.

1.02 RELATED DOCUMENTS

- A. Section 270500 and 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 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. 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.

1.04 QUALITY ASSURANCE

- A. Qualifications – Manufacturer
 - 1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.
- B. Qualifications – Installer:
 - 1. At a minimum, seventy-five percent (75%) of the onsite 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 FOUR PAIR CATEGORY 6A CABLING

- A. Basis-of-Design Product: Subject to compliance with requirements:
 - 1. Superior Essex
 - a. Category 6A CMP Rated
 - 2. Or approved 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. All category-6A performance four (4) pair cable shall consist of eight (8) twenty-four (23) gauge, or greater, thermoplastic insulated solid twisted conductors that utilize the industry standard color code designations.
 - 2. The performance criteria for four (4) pair cable shall be above and beyond specific EIA/TIA 568-C.2 standards for the particular cable's rating and shall show stable performance with documented electrical characterization out to 500 MHz.
 - 3. Four (4) pair cables must perform over and above each of the current specification parameters for the latest published twisted pair, 10Gb performance cable solution.
 - 4. Cables shall be rated per the installation environment as required by the local AHJ and local codes.
 - 5. Select an appropriate cable construction, including external jacket properties, when installing cables in aerial, outdoor, underground and corrosive environments.
 - 6. Cable to be run continuous without splices.
- D. Accessory Products:
 - 1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

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. 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 station cabling per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA 568C and BICSI, and in quantities indicated in the drawings.
2. Locations requiring horizontal cable shall be, but not limited to, work area outlet, AV and WiFi.
3. Install all cables with proper attention paid to bend radii, pulling method, attachment method, and pulling forces. All cable shall be pulled using an appropriate measuring device to ensure that the specified force is not exceeded as noted in BICSI installation guidelines. Also refer to the cable manufacturer's specifications for exact cable requirements per the particular cable type.
4. All cables 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.
5. Contractor shall ensure that all TIA/EIA and industry standards are met with special regards to maximum stripping length of cable jackets. No four (4) pair UTP cables shall have more than three-eighth inch (3/8") of cable jacket removed beyond the termination points.
6. Install the horizontal cabling with attention paid to aesthetic means and methods when routing cabling within IT spaces. All horizontal cabling shall terminate in their respective floor serving technology space; specifically cables from floor outlets need to terminate in their corresponding floor telecom room.
7. All cabling distributed horizontally through metal stud framing shall have plastic protective bushings inserted to protect cables prior to installation.
8. All cables shall be clearly labeled on both ends and in an accessible location no more than six inches (0'-6") from the cable ends.
9. The owner reserves the right to specify a new location for any outlet or equipment without increasing contractor unit cost – providing that the new location is specified prior to roughing-in of technology cable and is not farther than ten (10) feet away from the original location specified.
10. Communication EMT conduit sleeves shall receive conduit waterfall to control bend radius of the communication cable to a minimum of a 4" radius.

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. 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. 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
COMMUNICATIONS 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 UTP
 - 3. Single-Mode Optical Fiber Pigtail Connector Assemblies/Splice-On Connectors
 - 4. Outlet Housing Components (faceplates etc.)

1.02 RELATED DOCUMENTS

- A. Section 270500 and 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 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:

1.04 QUALITY ASSURANCE

- A. Qualifications – Manufacturer
 - 1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.
- B. Qualifications – Installer:
 - 1. At a minimum, seventy-five percent (75%) of the onsite 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. Systimax: Category UTP Category 6 Connectors.
 2. Or approved equal
- B. Product Options:
1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E.
- C. Description:
1. All UTP/STP 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/STP 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. Corning
- B. Product Options:
1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E.
- C. Description:
1. Single mode Optical fiber pigtail connector assemblies housed in manufacturers connector panels.
 2. FuseLite 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:
1. 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. Systimax
- 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 indicated 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 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. 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 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 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. 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. Contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

END OF SECTION

SECTION 27 41 16
INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The work under this section includes all final design, all labor, material, equipment, supplies, control and audio system programming, Speaker Alignment, testing, transportation and accessories required to furnish and install a complete-seamless, integrated Audiovisual Systems (AVS) as indicated on the drawings and as specified herein. The AVS shall be defined as all cables, equipment, products, etc, as indicated on the drawings, and mentioned in these specifications.
- B. It is the intent of the Drawings and Specifications, for the Contractor to design, provide and install a complete, fully operational, and tested system.
- C. All miscellaneous system components including, but not limited to, plenum cables, speakers, signal converters, interface panels and components, termination equipment, patch panels, backboards, converters, matrix switchers, digital video extenders, controllers, digital signal processors, amplifiers, pre-amps, custom faceplates, mounting hardware, fasteners, racks, cabinets, and any other related items shall be furnished and installed complete under this section, such that the system shall perform all functions listed herein in compliance with all of the specified requirements.
- D. Schedule is paramount to the project's success. With this, the Contractor will have to be a team player, continually working with the team to facilitate expeditious design, procurement, and construction processes.
- E. Project Summary:
 - 1. Conference / Break Room 121
 - The Conference / Break Room 121 shall include a wall mounted LED display. Audio shall be heard through the displays built-in speakers and control of the display will be through the displays infrared remote.

1.02 RELATED WORK, STANDARDS, DOCUMENTS AND PUBLICATIONS

- A. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of all Divisions of these specifications.
- B. All applicable portions shall apply to this section as though written herein completely.
- C. Contractor is responsible to reference all Architectural, Mechanical, Electrical, and Structural Drawings for additional information about pathways and or obstructions.

1.03 GENERAL REQUIREMENTS

- A. Manufacturer: The term "manufacturer" shall be defined as the company, or group of companies, that produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of ten (10) year's experience in manufacturing products of this type and shall be ISO 9001 Certified.

- B. Contractor: The term “contractor” shall be defined as the company, or group of companies, that installs the products per Section 3 of this document. The contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.
1. The Contractor shall hold a valid State of California C-7 Low-Voltage license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least five (5) years, and capable of being bonded to assure the Owner’s Project Manager of performance and satisfactory service during the guarantee period.
 2. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.
 3. All work shall be performed under the supervision of a company accredited by the manufacturer and such accreditation must be presented.
 4. The Contractor shall be a manufacturer’s authorized distributor and warrantee station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor must be certified by the manufacturer a minimum of 180 days prior to bid opening.
 5. The Contractor selected for this Project must adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
 6. Personnel: Use adequate numbers of skilled workers who are thoroughly trained and experienced with the specified requirements and the methods needed for proper performance of the AV systems installation work specified herein.
 7. Designated Project Engineer: Provide a designated Project Engineer in responsible charge of the Design, CAD, In-House testing and on the on-site commissioning of the Project during all phases of the work of this specification. This Project Engineer shall hold a current AVIXA (InfoComm) CTS-D and (insert Manufacturer specific requirement) certifications minimum and shall be the same individual through the execution of the work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.
 8. Technicians: shall have at least three (3) years direct experience in similar work. The AVS technicians assigned to this project shall be fully trained, qualified and carry valid and current industry certifications regarding the, installation, operation and testing of audiovisual systems. At least one AVIXA (InfoComm) CTS-I and (insert Manufacturer specific requirement) certifications shall be assigned as Lead Technician to the project.
 9. Custom Control System Programmer: Provide at least one (1) full time programmer on staff, capable of on-site custom programming of the custom remote-control system specified herein. Control System Programmer to hold the following certifications: AVIXA (InfoComm) CTS, and (insert Manufacturer specific requirement) certifications. A programming Sub-Contractor may be used as long as the Programmer has the certifications as listed above.
 10. Designated Project Manager: Provide a designated Project Manager in responsible charge of the fabrication shop and on the Project Site during all phases of installation and testing of the work of this specification. The Project Manager shall hold current AVIXA (InfoComm) CTS and shall be the same individual through the execution of the work

unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.

1.04 QUALITY ASSURANCE

- A. To maintain a high degree of quality assurance, the Contractor shall, without exception, use the parts and supplies as specified on the drawings and in this specification.
- B. For any proposed product substitution or when the Contractor intends to include an “or equal” product in the bid pricing, provide a substitution request submittal to the Owner’s Project Manager for review no later than fifteen (15) calendar days prior to Bid submittal. This report shall include:
 - 1. Description of how the proposed product(s) will impact meeting the project completion date, indicate item(s) with lead times and expected delivery date(s).
 - 2. Itemized cost comparisons between the proposed product(s) and the listed product(s).
 - 3. Detailed technical analysis of the electrical and mechanical specification differences between the proposed product(s) and the listed product(s).
 - 4. ETL “Verified” or UL “Verified” test lab documentation for the proposed product(s), component(s) and assemblies.
 - 5. Proposed product identification, manufacturer literature (specifications and cut sheets).
 - 6. Name, address and contact information of several similar projects where the proposed product(s) have been used.
 - 7. Name, address and contact information of the proposed product(s) manufacturer’s local representative.
 - 8. Sample proposed product(s) manufacturer’s warranty.
- C. The Owner’s Design Team/Project Manager must approve any proposed product(s) substitution item in writing. The Owner’s Design Team/Project Manager reserves the right to require a complete sample of any proposed product(s) and may request a sample tested by an independent testing consultant to prove equality. The decision of the Owner’s Design Team/Project Manager regarding equality of proposed product(s) items will be final.
- D. If a proposed product(s) is given final acceptance by the Owner’s Project Manager, the Contractor shall reimburse the Owner’s Design Team/Project Manager for the costs to review the proposed product(s) substitution(s), and for any additional engineering charges, and shall pay all charges of other trades resulting from this product(s) use, at no cost to the Owner.
- E. It is a mandatory requirement that a single Contractor perform the work described in this specification.

1.05 BID SUBMITTAL REQUIREMENTS

- A. Pre-Qualification Certificates: Provide current training certificates for design, engineering, installation and testing of the proposed products.
- B. Manufacturer Tests: Contractor shall submit all manufacturer test information prior to installation. If equivalent product(s) are substituted, the equivalent product(s) must show demonstrated and documented equivalence to the product(s) specified.
- C. Bid Forms: Contractor shall submit completed the detailed bid forms provided with this specification. Lump sum bids will not be accepted.

- D. Project Narrative: Contractor shall submit a summary of the scope of work, in Contractor's own words, illustrating a complete and thorough understanding of the project. The narrative shall include, but not be limited to room by room scope of work, project staffing and duration, quality assurance procedures and methodology, problem escalation procedures, and project schedule.
- E. Proposed Solution: The Contractor shall provide manufacturers cut-sheets for all the proposed materials that meet the requirements listed / described in Section 2 of this specification. On each cut sheet, provide an indicating arrow next to each part number of proposed material.
- F. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - 1. The Contractor shall hold a valid State of California C-7 Low-Voltage license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at least five (5) years, and capable of being bonded to assure the Owner's Project Manager of performance and satisfactory service during the guarantee period.
 - 2. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.
 - 3. A technical resume of experience for the Contractor's Project Manager who will be assigned to this project. This individual will remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner's Project Manager's written approval.
 - 4. All personnel performing work on this project must have successfully completed the manufacturer's installation training course prior to performance of any work on this project. Accreditation will consist of individual employee certifications issued by the manufacturer. Copies of certification of such training must be presented prior to any work performed on this project. A list of technical product installation training attended by the Contractor's personnel within the past two (2) years that will install the Contractor shall be submitted with the response.
- G. The Contractor shall furnish a letter from the manufacturer, which certifies that the contractor is the Authorized Distributor and that the equipment shall be installed according to manufacturer intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.
- H. The Contractor shall submit a detailed Bill of Materials developed for the project. The Bill of Materials shall contain a complete list of every component, part or device by part description, manufacturer and manufacturer's part number, quantity and unit of measure. See example format below. Product cut sheets shall be organized to match the order listed in the bill of materials. All cut sheets shall be numbered sequentially with matching page numbers indicated on the Bill of Materials. If more than one-part number appears on a cut sheet, Contractor shall identify the proposed part with a RED arrow or RED circle.

<u>Description</u>	<u>MFG & Part #</u>	<u>Quantity</u>	<u>Unit of Measure</u>	<u>Price</u>
Speaker	QSC Audio	1	Each	\$

- I. This information may be used by the Owner to evaluate the Contractor's general understanding of the project scope during the bid evaluation. Errors/Omissions from this bill

of material do not relieve the AVS contractor from providing all material, components, labor, etc., as outlined in this specification and on the drawings to provide a complete and useable AVS system.

- J. Provide 3 copies of the above information at bid time.

1.06 POST AWARD SUBMITTALS: SUBMIT WITHIN THIRTY (30) DAYS OF AWARD.

- A. Submittals shall be in three (3) deliverables, the first submittal shall be equipment cut sheets and equipment index in PDF format. The second submittal shall be electronic reproducible shop drawings including single line block drawings, equipment rack elevations, equipment locations, and mounting details (as pdf). The third submittal shall be control panel layouts, see below in paragraph G:
 - 1. A statement of sub-contractors, franchises, distributorship, dealerships, arrangements and agreements with manufacturers of equipment to be used for this work.
 - 2. Complete bill of quantities, including all material, components, devices and equipment required for this work. The bill of quantities shall be tabulated respective of each and every system as specified, in the order of the specification section 2 below, and shall contain the following information for each item listed:
 - a. Quantity
 - b. Description
 - c. Manufacturer's name and model number
 - d. Manufacturer's specification sheet
- B. Samples approved by the architect, of all finishes/materials which will be visible to the public. Including at least receptacles and controls with associates trim plate and each type of loudspeaker baffle and/or grille.
- C. Functional Diagrams: single-line block diagram showing interconnection of all components, receptacles, terminal blocks, controls, transformers and loudspeakers in addition to the active elements. Include terminal and cable numbers, all system and component labels. Show detailed system component information including but not limited to manufacturer's name, model number, any specialized part number option and all input and output connection information, for each piece of equipment. No drawing codes shall be permitted. Provide one (1) full-scale original or photograph (not blueprint) copy for each system. All shop drawing shall follow The AVIXA (InfoComm) standard ANSI-J-STD-710 for audio, video, and control.
- D. Equipment rack elevation drawings scaled (1-1/2" = 1'-0" or larger):
 - 1. Front Elevations: include equipment designation, manufacturer's name, model number, rack location and rack designation.
 - 2. Rear Elevations: include AC power wire-ways and route of wiring harnesses.
- E. Samples for approval by the architect of all finishes/materials that will be visible to the public including at least receptacles and controls with associated trim plate and each type of loudspeaker baffle and/or grille.
- F. Contractor fabricated items, detailed drawings showing all components, devices and equipment, including dimensions, component values, terminal designations, types, locations, manufacturer's name and model number.

- G. The third submittal shall be Control Panel Layouts: Developed drawings of all control system panel layouts after meeting with the Owner to review the system functionality they are expecting.
 - 1. Prior to programming the remote-control system, the Contractor shall submit shop drawings per the project standards showing all control screen layouts, graphical user interfaces (GUI) and control descriptions of all remote-control system functions to the PM for review and comment prior to actual programming of the system. Submit in native file format and hard copy form. Shop drawings shall include control screen layouts of the touch panel pages for each venue, web page layouts (as required in Part 2 below). Submit electronic versions for PM review. The Contractor shall incorporate all PM comments into the programming of the systems.
 - 2. Prior to delivery of the systems to the job site, the Contractor shall demonstrate fully functioning systems in the Contractor's facilities that include the remote-control programming. This demonstration shall coincide with the PM's Representative observation of completed sub-assemblies. The PM will review and comment on the remote-control programming submittal, and the Contractor shall incorporate all PM comments into the programming of the systems.

1.07 GENERAL SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

- A. Prior to Owner acceptance, the Contractor shall provide to the Owner's Project Manager, a manufacturers product and performance warranty. This will require a submittal of the required pre-job certification registration forms as well as the required project closing information. The Owner will only acknowledge acceptance upon submittal of a valid manufacturer's warranty.
- B. Manufacturer's Site Certifications will not be accepted.
- C. The warranty shall commence from the date of the Owners final written acceptance of the completed project.
- D. All conditions for obtaining the manufacturers warranty shall be the sole responsibility of the Contractor.
- E. The Contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the Owner after the end of the guarantee period.
- F. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

1.08 SPECIFIC SYSTEM PRODUCT, INSTALLATION AND OVERALL SYSTEM WARRANTY

- A. Prior to Owner acceptance, the Contractor shall provide to the Owner's Project Manager, a manufacturers product and performance warranty. This will require a submittal of the required pre-job certification registration forms as well as the required project closing information. The Owner will only acknowledge acceptance upon submittal of a valid manufacturer's warranty.
- B. The warranty shall commence from the date of the Owners final written acceptance of the completed project.

- C. All conditions for obtaining the manufacturer's warranty shall be the sole responsibility of the Contractor.
- D. The Contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the Owner after the end of the guarantee period.
- E. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

PART 2 PRODUCTS AND AUDIOVISUAL SYSTEM SCOPE OF WORK

2.01 ACCEPTABLE MANUFACTURERS

- A. It is the responsibility of the bidder to ensure that the proposed product meets or exceeds every standard set forth in these specifications and the equipment's technical data sheets.
- B. The functions and features specified are vital to the operation of this facility. Therefore, inclusion of a component's manufacturer in the list of acceptable manufacturers does not release the Contractor from strict compliance with the requirements of this specification.

2.02 SYSTEM FUNCTIONS AND CAPABILITIES:

- A. The Audiovisual Systems (AVS) equipment will be housed in the AVS rack. The AVS shall be controlled by a control system for the system functionality.
- B. The AVS shall comply with AVIXA A102.01:2017 Audio Coverage Uniformity in Listener Area.
- C. The AVS shall provide clear, natural sound uniformly distributed throughout the designated areas. The system shall utilize speakers as shown on the plans. These quantities shall be considered as the minimum quantity required. If additional speakers are needed to meet the requirements of section 2.02 sections C thru G below, the Contractor shall include all costs for added speakers in the base bid.
- D. The system shall have adequate dynamic range without audible clipping or distortion to accommodate all types of program material. Audio, Digital Signal Processing shall be employed in the designated rooms to insure smooth frequency response, high acoustical gain before feedback. When at maximum level, the system shall operate without audible distortion, rattles and buzzes. All switching shall be silent and without pops and/or transients.
- E. The system frequency response shall be within +/- 2dB from a curve which is flat from 80Hz to 4kHz and decreasing 3dB per octave from a relative level of 0 dB from 4kHz to 10kHz. There shall be a minimum 12dB roll-off above 10 kHz and below 63 Hz. Uniformity of coverage of the system at seated ear height (42") shall be within +/- 3dB in the 4kHz 1/3 octave band at any seat location using pink noise as a test signal.
- F. System noise shall not exceed an equivalent input noise of -120dB based on a 20KHz-noise bandwidth. The predominant noise component in the system output under any operating condition shall be that of the input stage.
- G. The sound level capability of program material levels produced in all seats shall be at least 105dB when measured with a scaled filter. There shall be at least 6dB of amplifier headroom.

- H. The system shall provide clear audio to all areas covered by the system. Each speaker zone shall be wired discretely to the correct zone on the amplifier. See AVS drawings for exact location.
- I. Contractor will review and assess the appropriate Lens Throw length between the video projectors and the projection screens to ensure optimum picture sizing and focus. Make all adjustments necessary, including projector keystone correction (if the projector cannot be placed in the optimum location) and lens shift to achieve the image size and shape required.
- J. Provide full video projector calibration and adjustments for optimal picture quality for all used inputs. Provide proper aspect ratio configuration for 16:9 and 16:10 sources. Set all projector configuration presets required for control system recall coordination, and provide with final system documentation.
- K. Verify image Contrast to perform to AVIXA (INFOCOMM) 3M-2011, Projected Image System Contrast Ratio.
- L. Provide full flat panel monitor display calibration and adjustments for optimal picture quality for a single HDMI, DisplayPort (DP) or DVI-D input. Provide proper aspect ratio configuration for 16:9 and 16:10 sources. Use a test generator (I.E. Extron VTG Series, Hall Research PGA-VHD, or Teledyne 780): for all setup verification, and verify proper image configuration with the all inputs. (Contract the Owner's Technical Representative prior to final adjustment to coordinate).
- M. Controls: Adjust all controls to achieve the specified performance. Provide covers for all level controls, as appropriate to prevent unauthorized gain changes. Contractor will confirm that all control system operations are properly programmed and repeatable.
- N. Testing Report: Provide a letter/report documenting the results of these preliminary tests, including amplifier gain/level settings, DSP Gain & EQ filter settings, and AV equalization curves for review by the AV Design Consultant.
- O. See wiring device section of this specification for wiring device plate cover labeling requirements.
- P. See drawings for panel board schedule directory installation requirements.
- Q. See conduit installation section of this specification for conduit labeling requirements.
- R. Software Programming
 - 1. General
 - a. Except when otherwise agreed in writing the client shall retain legal and beneficial ownership of all Intellectual Property, including source code, created by the Contractor, their employees and sub-Contractors.
 - b. The Contractor must allow sufficient time for the programming of all software configurable audio, video and control systems. Contractors must evaluate the systems functional requirements and user interface and then allow time in their bid accordingly. The system description as well as the end user interview will provide the Contractor with the necessary information needed to proceed with the programming. Any questions as to the systems functional requirements must be sent in written RFI form to the Owner and Consultant. All programming schemes must be submitted to the Owner and Consultant for approval before

programming starts. This includes the appearance of all user interfaces, touch panel layouts, preset and sub-preset information (acquired through client interviews), and speaker control schemes. The Contractor will also submit a narrative for the control system concept to the Consultant for approval. The Contractor is to interview the Owner and their representatives to acquire the necessary information needed to allow for the proper programming of this system. The Contractor, after interviewing the Owner, will then submit a written report stating his interpretation of the Owner's requirements for approval by Consultant. Only after the Owner and Consultant have approved the programming report may the Contractor proceed with the programming of this system.

- c. All equipment that is connected to the Owner's local area network and is configurable via the local area network must have its equipment software installed onto Owner furnished dedicated computers by the owners Information Technology Staff unless otherwise indicated. The Contractor is to allot time to test equipment software loaded on the Owner's computers which are to be identified by the Owner and/or Consultant. The computers will be programmed to emulate user interfaces throughout the facility. The Contractor shall coordinate all software deployment over IP with the Owner's Information technology department.
- d. Control system minimum programming outlined below:
 - 1.) The Contractor shall allot time, as needed for on-site control system programming with the Owner representative.
 - 2.) All serial controlled devices must have bi-directional communication with the control system. All control functions locally available on each device must be accessible via the remote-control system. All locally gestured control functions must mirror on the control system user interface. In other words, if a volume control is adjusted on a DSP interface that adjustment must register on the control interface.
 - 3.) Control system shall be used to power up and down connected equipment where indicated. The control system shall control the volume levels for the program audio, wireless microphones if applicable, select video sources and media input panel (MIP) in the floor boxes and wall plates, transport and control functionality for playback equipment from the wall mounted 7" and 5" and a table top 7" LCD control panel in the room. The control panel may require a POE injector located in the AV rack or behind the display.

2.03 AUDIOVISUAL SYSTEM PRODUCTS

- A. The system shall utilize AV products as shown on the Plans and listed below. These products shall be considered to be the minimum quantity, performance, functionality and quality levels. If additional and/or upgraded components are needed to meet the performance requirements of this specification, the Contractor shall include all costs for such added and/or upgraded components in the base bid.
- B. Conference / Break Room 121

1. Display System:
 - a. 1-Each, Samsung HG55NJ690UFXZA, 690U Series 55" Commercial LED Display.
 - b. 1-Each, Chief LSM1U, Large Fusion Fixed Wall Display Mount.
 - c. 1-Each, Chief PAC525F, In-Wall Display Back Box with Flange .
 2. Misc.:
 - a. 1-Each, Logitech C930E, FHD Webcam with Built-in Microphones.
- C. ADA-COMPLIANT ASSISTIVE LISTENING SYSTEM: A complete system shall be furnished and installed to meet the latest ADA 2010 requirements for hard-of-hearing for each system. Furnish portable receivers in as indicated in the table below. The Stationary Assistive Listening System shall be integrated into and work in conjunction with the sound reinforcement systems. Mount the necessary stationary transmitters into the equipment racks or a wall cabinet and adjust as required for total coverage of seating areas Assistive Listening Transmitters shall operate in the RF or IR frequency range.
1. *Note: As per Paragraph C ADA Table 219.3 below, provide the number of receivers, ear sets, rechargeable batteries and charging units and for a fully functional and compliant Assistive Listening System per ADA requirements.
 2. ADA Table 219.3 Receivers for Assistive Listening Systems

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number or Required Receivers Required to be Hearing Aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats ¹	2
201 to 500	2, plus 1 per 25 seats over 50 seats ¹	1 per 4 receivers ¹
501 to 1000	20, plus 1 per 33 seats over 500 seats ¹	1 per 4 receivers ¹
1001 to 2000	35, plus 1 per 50 seats over 1000 seats ¹	1 per 4 receivers ¹
2001 and over	55, plus 1 per 100 seats over 2000 seats ¹	1 per 4 receivers ¹

Note: 1. or fraction thereof.

2.04 GENERAL PRODUCTS FOR SYSTEMS

A. CABLE – ALL SPACES

1. HDBaseT, Digital Video Twisted Pair Cable, Manufacturer & Part Number, Shielded Twisted Pair Cable, Plenum Rated: (Quantity as required). With Only Shielded RJ-45 Connectors.
2. Distributed Loudspeaker 18-2, 18 AWG, 2-conductor Plenum Rated (70 volt): Belden, or equal.

3. Analog Microphone/Line Level cable, 2-22 (22 AWG conductor, jacketed, shielded, twisted-pair) plenum rated: Belden or equal.
4. Control System Device Control (RS232, Relay or Contact Closure): (Dual 22 AWG shielded twisted pairs with individual drain wires; each pair is color-coded Red/Black and Green/White to simplify identification.) Plenum Rated: Belden or equal.
5. Infrared Emitter and cable, Xantech or equal.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. The installation, configuration, and wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the Contractor shall notify the Owner's Project Manager before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
- C. The cables within the rack or cabinets shall be labeled/numbered for identification following the AVIXA (InfoComm) F501.01:2015, Cable Labeling of Audiovisual Systems, standard unless otherwise directed.
- D. Splices of cables in underground pull boxes are not permitted unless otherwise noted on the drawings.
- E. The labor employed by the Contractor shall be regularly employed in the installation and repair of audiovisual systems and shall be acceptable to the Owner's Project Manager to engage in the installation and service of this system.
- F. The Contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The Contractor shall remove all debris and rubbish created in the course of this project. The Contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.
- G. The system must meet all local and other prevailing codes.
- H. All cabling installations shall be performed by qualified technicians.
- I. All cabling shall be splice free unless otherwise noted on drawings.
- J. In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.
- K. The use of lubricants (i.e. Yellow 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the AVS Contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed.
- L. Under no circumstance are "channel locks" or other pliers to be used.

- M. Cables may be run exposed above ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The Contractor shall include all costs in base bid for any additional supports/seismic bracing required by the Local Authority having Jurisdiction. The cables shall not be laid directly on the ceiling panels. The use of hook and loop ties shall be done in accordance with the cable manufacturer's requirements. The cable jacket composition must meet local and all other prevailing fire and safety codes – “Plenum Rated” cable shall be used.
- N. All fire rated walls penetrated by Contractor shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of NFPA and the NEC or other prevailing code and must be a system listed by UL. The Contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wire ways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area. This requirement also applies to maintaining fire ratings of all floors penetrated by conduits or devices designated for use by voice and data cabling.
- O. All equipment racks shall be bolted to the floor by the Contractor in the location shown on drawings. The earthquake mounting brackets that come with each rack kit shall be screwed to studs, not drywall.
- P. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor before final acceptance at no cost to the Owner.
- Q. The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.
- R. Cable raceways, when required, shall not be filled greater than 40% of cross sectional area.

3.02 SPECIFIC SYSTEM INSTALLATION REQUIREMENTS

- A. All Audiovisual cabling used throughout this project shall comply with the requirements as outlined in the NEC Articles 725, 760, 770, and 800 and the appropriate local codes. All copper cabling shall bear UL listed type CMP (Plenum Rated). All fiber optic cabling shall bear OFNP (Plenum Rated). Contractor is responsible for installing appropriately rated cable for the environment in which it is installed. For cables run outside of a building to outdoor speakers, the cable shall be Outdoor Plant Rated (OPR) or Direct Burial cable and must be run in conduit point to point. For longer cable runs between buildings fiber optic cable shall be used, the fiber cable shall be run in conduits.
- B. Cable Pathways:
 - 1. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle cabling with half inch hook and loop strips, but not deforming the cable geometry. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Plenum rated hook and loop ties will be used in all appropriate areas. The Contractor shall adhere to the manufacturers’ requirements for bending radius and pulling tension of all cables.
 - 2. Cables or J hooks shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
 - 3. Cables or J hooks shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

4. Where additional conduit(s)/sleeve(s) are required, but not provided by the electrical contractor, the Contractor shall be responsible to provide such conduit(s)/sleeve(s). Conduit(s) and sleeve(s) shall be of suitable material, sized, installed, fire-stopped, and grounded as required by the NEC, ANSI/TIA/EIA standards and all other applicable codes and standards. Any conduit(s) and sleeve(s) added by the Contractor shall be approved by the Owner's Project Manager prior to rough-in.
- C. The Contractor shall be responsible for damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
- D. Rack mounted equipment shall be grounded via the chassis, in accordance with manufacturer's instructions. The equipment chassis shall be bonded to the rack/cabinet using one of the following methods:
 1. If the equipment has a separate grounding hole or stud, use a # 6 AWG ground wire from the chassis ground hole/stud to the rack grounding bus if required.
 2. If the manufacturer suggests grounding via the chassis mounting flanges, use tri-lobular thread-forming screws (not self-tapping or sheet metal screws) to attach the equipment to the rack/cabinet rails. If the equipment mounting flanges are painted, remove the paint and apply an anti-oxidant, or use tri-lobular thread-forming screws and two (2) "Type B" internal-external tooth lock washers to safely ground equipment to the rack.
 3. All equipment racks shall be grounded to the AC outlet box or building ground by a # 6 AWG Green ground wire attached to the Grounding lug in the rack.

3.03 GENERAL INSTALLATION DESCRIPTION

- A. The labor employed by the Contractor shall be regularly employed in the installation and repair of Audiovisual Systems and shall be acceptable to the owner and architect to engage in the installation and service of this system.
- B. The Contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., The Contractor shall remove all debris and rubbish occasioned by the work from the site. The Contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., Caused by the performance of this work.
- C. Labeling
 1. Wiring Labels: At all connection points for all types of cable & wiring, a label strip shall be attached at both ends of the cable following the AVIXA (InfoComm) F501.01:2015 Cable Labeling of Audiovisual Systems, standard unless otherwise directed, indicating the name/number of that cable or wire as follows:
 - a. At internal locations (inside racks, cabinets, or boxes), a pressure sensitive label shall be used.
 - b. At external locations, a printed label covered with clear shrink wrap or approved labeling system shall be used.
 2. Equipment Labels: All active components shall have labels at the front and rear.
 - a. Labels shall be applied plumb and neat and shall not cover any equipment lights, recessed controls, or control labels.
 - b. Front labels shall indicate functional use of equipment.

- c. Rear labels shall indicate system schematic reference designation.
- 3. Contractor Label: Contractor name plate shall be attached to a blank panel inside each equipment rack or group of racks.
 - a. Name plate shall be printed, self-adhesive type and shall be no larger than 1-3/4" high by 6" wide. Alternatively, name plate may be preprinted onto a 1RU blank panel.
 - b. Name plate shall contain Contractor's name, city/state address and phone number.
- D. Equipment Rack and Equipment Testing and Adjusting Procedures: Conduct procedures in fabrication shop following the AVIXA (InfoComm) 10:2013 Audiovisual Systems Performance Verification procedure. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report with color photographs of each equipment rack, front and back. Perform at least the following procedures:
 - 1. Preliminary: Verify:
 - a. Grounding of devices and equipment. Integrity of signal and electrical system ground connections.
 - b. Proper provision of power to devices and equipment.
 - c. Integrity of all insulation, shield terminations and connections.
 - d. Integrity of soldered connections. Absence of solder splatter, solder bridges.
 - e. Absence of debris of any kind, tools, etc.
 - f. Routing and dressing of wire and cable.
 - g. All wiring, including polarity and continuity, including conformance with wire designations on running sheets, field and shop drawings.
 - h. Mechanical integrity of all support provisions.
 - i. All wiring in racks on horizontal lacing bars and vertical cable paths shall have Velcro cable wraps, no Zip Ties shall be allowed. If Zip Ties are used, they shall be replaced at the Contractor's expense.
 - 2. Rig temporary power and grounding: Comply with all applicable Codes, regulations and ordinances.
 - 3. Determine the proper sequence of energizing systems to minimize the risk of damage. Energize. Burn in for at least 48 hours
 - 4. All equipment racks shall be bolted to the floor by the Contractor (unless noted) once the Owner determines the exact location for each rack. The earthquake mounting brackets that come with each rack kit shall be screwed to studs, not drywall. All equipment shall be serviceable in the racks final location – the need to unbolt racking equipment to access or service equipment is not acceptable.

3.04 PROJECT DIRECTION

- A. Single Point of Contact: Contractor will provide a single point of contact, i.e., Project Manager, to speak for the Contractor and to provide the following functions:

1. Initiate and coordinate tasks with Owner's Project Manager, and others as specified by Owner's Project Manager.
2. Provide day-to-day direction and on-site supervision of Contractor personnel.
3. Ensure conformance with all Contract provisions.
4. Participate in weekly site project meetings.
5. This individual will remain as Project Manager for the duration of the project. The Contractor may change Project Managers only with the Owner's Project Manager's written approval.

3.05 PLANNING, ENGINEERING AND SUBMITTALS

- A. Planning meetings and schedule: Within thirty (30) calendar days after the date of award of the Contract, an initial planning meeting will be held with the successful bidder to clarify all requirements (systems, services, distribution methods, etc.), identify responsibilities, and schedule the events that will transpire during the implementation of the project. Within one (1) week of this initial meeting, the contractor shall provide a written report and project schedule to clearly document the events and responsibilities associated with the project.
- B. Within Thirty (30) calendar days after the date of award of the Contract, the Contractor shall submit three copies of the complete submission to the Owner's Project Manager for review. The submission shall consist of four major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.
 1. The first section shall be the "index" which shall include the project title and address, name of the firm submitting the bid and name of the Owner.
 2. The second section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all of the specified equipment's features and functions as stated in the specifications and data sheets.
 3. The third section shall contain an original manufacturer data sheet for every component listed in the drawings or specifications.
 4. The fourth section shall contain a designation schedule for each system component location and complete "E" size (30" x 42"), unless otherwise specified, bond drawings, showing system wiring plans. The drawings shall be professionally drafted, generated on AutoDesk AutoCAD 2010 computer design software. These drawings shall also include:
- C. As-Built/Closeout Documentation: Within fifteen (15) days after the completion of work (signed off by Owner), the Contractor shall provide a complete Contractor-provided set of professionally drafted "E" size (30" x 42"), unless otherwise noted, reproducible bond as-built drawings, generated on AutoDesk AutoCAD 2014 computer design software. Contractor will supply to Owner one set of CDs containing all as-builts.
- D. As-Built Documentation Display in each equipment rack location: Within fifteen (15) days after the completion of work, the Contractor shall install a complete Contractor-provided, professionally drafted as-built floor plan in color in each equipment rack room mounting frame. Each floor plan, generated on AutoDesk AutoCAD 2014 computer design software and printed in black and white, shall depict all audiovisual jack locations in each room with an audiovisual system and all other areas. The Contractor will provide to Owner one set of CDs containing all as-built.

- E. Controls: Adjust all controls to achieve the specified performance. Provide security covers for all level controls, as appropriate to prevent unauthorized gain changes. Contractor will confirm that all control system operations are properly programmed and repeatable.
- F. Testing Report: Provide a letter/report documenting the results of these preliminary tests, including amplifier gain/level settings, crossover filter settings, and AV equalization curves for review by the Owner and the AV Design Consultant.
- G. Qualification for Acceptance: After completing preliminary testing, the Contractor shall furnish the Construction Manager with the letter/report documenting the results of the preliminary tests and five (5) copies of "as-built" wiring diagrams of the entire system including the connection numbers, and their locations. The receipt of this documentation will constitute the Contractor's acknowledgment that the installation is complete and conforms to this specification, and is ready to be reviewed and tested by the Owner and the AV Design Consultant.
- H. Acceptance Test: The Consultant, Owner's Representative and/or Construction Manager will be present during the acceptance testing and require the assistance and cooperation of the Contractor. Provide personnel who participated in the actual installation and preliminary testing and adjustment of the audiovisual systems.
 - 1. Equipment cabinet keys and any tamper-proof fastener tools must be available to the Owner and the AV Design Consultant. Delays associated with failure to access the equipment will be back-charged to the Contractor at the AV Design Consultant's current hourly rates.
 - 2. Each major component shall be demonstrated to function, as specified.
 - 3. Measurements: Further electrical and acoustical measurements may be performed at the discretion of the Owner and/or Owner's Representatives. Acoustical test equipment will be supplied by the Contractor. Such measurements may include sound pressure levels, uniformity of coverage, distortion, or other pertinent characteristics.
 - 4. The Contractor shall provide a laptop with all manufacturer supplied configuration software necessary for communicating with DSP Audio Matrix Mixers. A review of system settings may be required for either of the programmable units at the Owner and the AV Design Consultant's request, and settings may be adjusted if necessary.
- I. Such tests may be performed on any piece of equipment or system. If any test shows the equipment or system is defective or does not comply with the specifications, the Contractor shall perform any remedies at his expense and pay the subsequent expenses of any retesting required.
- J. Delays: If the acceptance of the system is delayed because it does not meet the specification requirements, the Contractor shall reimburse the Owner for all expenses of consultants retained to represent the Owner during the final acceptance testing. This will include costs associated with travel to the site, and include reimbursable business travel expenses.

3.06 INSTALLATION

- A. All installation shall be done in conformance with ANSI/TIA/EIA and AVIXA (InfoComm) standards and manufacturers installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the

appropriate guidelines will require the Contractor to provide, in a timely fashion, any additional material and labor necessary to properly rectify the situation to the satisfaction and written approval of the Owner's Project Manager. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

1. **Bonding and Grounding:** The Contractor shall be responsible for providing an approved ground at all racks. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and racks. All grounds shall consist of #6 AWG copper wire and shall be supplied from an approved building ground and bonded to the main electrical ground. Grounding must be in accordance with the NEC, NFPA, ANSI-J-STD-607-A and all local codes and practices.
2. **Power Separation:** The Contractor shall not place any low voltage and speaker cabling alongside power lines, or share the same conduit, channel or sleeve with in racks.
3. **Miscellaneous Equipment:** The Contractor shall provide any necessary screws, anchors, clamps, hook & loop ties, distribution rings, wire molding, miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the System.
4. **Special Equipment and Tools:** It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the System. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper/fiber cables, communication devices, jack stands for cable reels, or cable winches.
5. **Labeling:** The Contractor shall be responsible for printed labels for all cables and cords, distribution frames, and outlet locations, according to the specifications. No labels are to be written by hand. The labeling shall follow the AVIXA (InfoComm) F51.01:2015 standard unless otherwise directed.

3.07 DAMAGES

- A. The Contractor will be held responsible for any and all damages to portions of the building caused by it, its employees or subcontractors; including but not limited to:
 1. Damage to any portion of the building caused by the movement of tools, materials or equipment.
 2. Damage to any component of the construction of spaces.
 3. Damage to the electrical distribution system.
 4. Damage to the electrical, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.
 5. Damage to the materials, tools and / or equipment of the Owner, its consultants, agents and leases tenants.

3.08 PENETRATIONS OF WALLS FLOORS AND CEILINGS

- A. Unless specifically shown on the drawings, the Contractor shall make no penetration of floors, walls or ceiling without the prior written approval of the Owner's Project Manager.
- B. Any penetrations through acoustical walls or other walls for cable pathways shall be sleeved by the Contractor. Sleeves shall consist of metallic conduit deburred and grommetted on both ends, with flanges or other means to prevent the sleeve from slipping or falling out of the partition. Sleeves shall extend a minimum of 6" on both sides of the partition. Outside

perimeter of sleeves shall be sealed against sound, air, heat, or as required by partition design. Inside of sleeve shall be sealed similarly after installation of all cabling. Cables shall be independently supported on either side of the sleeve. Sleeves shall not be used as cable supports. Additional requirements in compliance with applicable code shall apply.

- C. Any penetrations through fire-rated walls for cable pathways/cables shall be sealed by the Contractor as required by code and as directed by Owner's Project Manager. The Contractor shall be required to work together with the General Contractor and the Electrical Contractor to coordinate and develop all fire stopping methods prior to any cable installation. The Contractor shall also, prior to the commencement of on-site activities, submit to Owner's Project Manager, details of any special systems to be used.

3.09 TESTING/WARRANTY

- A. The Contractor shall provide competent, factory-trained engineers and/or technicians, authorized by the manufacturer of the AVS, to technically supervise and participate during all tests for the systems. All performance testing shall follow the AVIXA (InfoComm) 10:2013 Audiovisual Systems Performance Verification procedure.

3.10 COMPLETION OF WORK

- A. At the completion of the System, the Contractor shall restore to its former condition, all aspects of the project site and on a daily basis, shall remove all waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this Contract. All clean up, restoration, and removal noted above shall be by the Contractor and at no cost to Owner. If the Contractor fails in its duties under this paragraph, Owner may upon notice to the Contractor perform the necessary clean up and deduct the costs thereof from any amounts due or to become due to the Contractor. It shall be the Contractor's responsibility to remove trash from the areas it is working in and bring trash and debris to the Contractor provided dumpster.

3.11 INSPECTION

- A. On-going inspections shall be performed during construction by the Owner's Project Manager. All work shall be performed in a quality manner and the overall appearance shall be clean, neat and orderly.

3.12 MISCELLANEOUS PROJECT REQUIREMENTS SYSTEM DOCUMENTATION, TRAINING, AND FIELD SUPPORT

- A. Operation and Maintenance Manuals: As part of the "Close Out" documents, for each system, provide five (5) copies of system manuals per system. Manuals shall be in adequately sized three-ring binders, clearly labeled on spine. Manuals shall contain the following:
 1. Service Reference Cover Sheet: Provide a cover sheet with Audiovisual AVS Contractor name, address, Email, WEB Address, telephone and Fax numbers.
 2. System Operation Instructions: Step-by-step operating instructions based on the control system touch panel (if applicable) for the basic day-to-day use of the system including power activation, connection of source devices, adjustment of volume levels, selection of sources, etc. Include illustrations and references to individual equipment manuals as necessary.

3. Equipment Manuals: Include copies of individual equipment operation manuals separated by tabbed dividers. Order the manuals in nominal signal path order (i.e. sources first, amplifiers/loudspeakers last), followed by control system manuals, followed by miscellaneous manuals.
 4. Equipment List: List all system equipment including, connectors and specialty hardware, by manufacturer and model and serial number.
 - a. As-built Drawings: Provide reduced 11"x17" foldout "as built" functional diagrams in clear plastic binder sleeves. Fold and insert drawings so that drawing title is clearly visible at the front of the sleeve. Five (5) half or full-size drawing sets are also to be provided for clearer system reference.
 - b. Provide software programmable device configuration files to the Owner for all control system interfaces and computer-based files, and the DSP Audio Matrix Mixer. Store files on site in the system documentation binders in disk sleeves. Provide the files on CD-ROM.
- B. Training: Provide as needed system training to operator(s) designated by the Owner. Training time is to be non-contiguous, in multiple separate sessions. Training sessions are to be videotaped upon Owner request.

3.13 MISCELLANEOUS SUPPORT REQUIREMENTS

- A. Upon approval of shop drawings and equipment submittals, Contractor shall immediately place orders for all required materials, components, and supplies especially long lead items. In addition, Contractor shall secure and forward written confirmations (including orders and shipping dates) direct from each manufacturer/vendor to the Owner's Project Manager.
- B. Contractor shall expedite shipment of all materials, components and supplies, as necessary to ensure the successful completion of the Project by the date required. All costs for expediting shall be included within Contractor's pricing as provided below.
- C. The system/network cost herein shall include administration/maintenance training for at least ten Owner's representatives with a minimum allotment of sixteen hours. All training shall include written and/or video materials that shall remain the property of Owner. If materials are written, they shall be provided in quantities sufficient for each person trained; if materials are video, one copy of each will be required. The administration/maintenance training shall include, but not be limited to, the following:
 1. Review of as-built documentation, including a site demonstration.
 2. All warranty information.

3.14 AV SYSTEM AND/OR NETWORK TESTING

- A. Upon completion of installation, Contractor shall execute all of the required tests as summarized in this specification. When all such tests have been completed to Owner's satisfaction and Manufacturer's specifications, Contractor shall give the Owner written notice thereof.
- B. Contractor must assume responsibility of assuring that the AV system and/or network installed operates properly, including any required coordination with other suppliers.

3.15 FINAL ACCEPTANCE

- A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.
- B. The Owner or Owner's representative will conduct a final job review once the Contractor has finished the job. This review will take place within one week after the Contractor notifies the owner.
- C. Two copies of all certification data and drawings for all identifications shall be provided to the Owner before the owner's review.
- D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.
- E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the Contractor.
- F. In the event that repairs or adjustments are necessary, the AVS Contractor shall make these repairs at his own expense. All repairs shall be completed within 5 days from the time they are discovered.
- G. The Contractor shall hand to the owner a copy of any applicable installation specific software configurations in CD format.

END OF SECTION

SECTION 28 31 11
DIGITAL ADDRESSABLE FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Fire detection and alarm system.
 - 2. Fire alarm control panel (FACP) compatible with the existing CAMPUS Fire Alarm Monitoring Station.
- B. Related Sections:
 - 1. Division 26 Electrical sections, for general electrical requirements, conductors, conduit and raceway.

1.02 DEFINITIONS

- A. Where this Section references CALIFORNIA STATE Fire Marshal involvement, the Contractor's contact with the CAMPUS Fire Marshal shall be via the College's Representative. All documents and other materials shall be submitted to the College's Representative.
- B. Whenever the term "system" is used herein without additional modification, it shall be taken to mean the fire detection and alarm system. The system shall be as defined in Section 204(c), Title 19, California Code of Regulations. It shall not be construed as including auxiliary circuits such as those associated with elevator recall, elevator machine electrical power disconnection, fan and smoke control system controls/devices, magnetic door hold-open release relays, and/or automatic-closing doors.
- C. Unless otherwise specified, all system circuits (including, but not limited to initiating device, notification appliance, and relay circuits) shall be considered to start and end at the FACP.

1.03 PERFORMANCE REQUIREMENTS

- A. The entire system shall conform to Titles 8, 19, and 24; California Code of Regulations, including all referenced standards. All equipment shall be UL Listed, FM-approved, and currently listed by the California State Fire Marshal.
- B. At the minimum, include the following:
 - 1. Provide an FACP and main fire alarm terminal cabinet (MFATC), as specified herein and as indicated on the drawings. Provide additional fire alarm terminal cabinets (FATCs), as specified herein, in the additional locations specified herein and as indicated on the drawings.
 - 2. Provide smoke, heat, and duct-mounted smoke detectors, and manual pull stations, as specified herein and as indicated on the drawings.
 - 3. Provide audible/visual notification appliances and visual notification appliances, as specified herein, throughout the facility as indicated on the drawings and/or in accordance with ADA requirements.
 - 4. Provide a visual annunciator with legend, as specified herein and as indicated on the drawings.

5. Provide duct-mounted smoke detectors in the main supply-air duct(s) to effect shutdown of each air handler rated at supplying more than 2000 CFM. Provide duct-mounted smoke detectors to actuate smoke/fire dampers as shown on the drawings.
6. Provide a building location strobe light, as specified herein and as indicated on the drawings.
7. Provide a smoke detector to protect every fire alarm control unit (including, but not limited to: the main fire alarm control panel, every additional fire alarm control panel, every transponder panel, every auxiliary power supply, and every notification appliance power extender).

1.04 SUBMITTALS

- A. Approval from the College's Representative and CALIFORNIA STATE Fire Marshal must be obtained for all components of the system submittal (including but not limited to: system contractor qualifications, material data sheets, and shop drawings). Submittals having any content which is incomplete or unclear will be returned without review or approval. If all components of the system submittal have not been approved due to Contractor's incompleteness or errors, the College shall have the right to require the Contractor to cancel the system contractor's contract and to engage the services of a substitute system contractor at Contractor's expense.
- B. Submit catalog data sheets for all materials. Submit factory installation manuals/sheets for each component to be installed in the system. Data sheets/factory installation manuals/sheets are required for all system components, including but not limited to: control units, batteries, battery chargers, initiating devices, audible notification appliances, visual notification appliances, annunciators, terminals, cabinets, enclosures, conduit, wiring conductors, and relays. All equipment drawing alarm or supervisory current shall have documentation of the current draw highlighted in the submittal information. Submittals shall include State Fire Marshal Listing Sheets, including listing number with annual update and expiration date, for every system component. Submittals will be automatically rejected if complete listing information does not accompany submittal.
- C. In addition, submit one original copy of the latest edition of the operation, maintenance, and installation manual(s) (whichever exist) for each FACP submitted. This is to be-forwarded directly to the Fire Marshal.
- D. Submit shop drawings.
- E. After approval of the above materials submittal, submit installation shop drawings, prepared by a designer who has been factory-trained on the specified FACP. Working drawings shall be submitted in complete sets (partial submissions will not be accepted). Working drawings shall include, at a minimum:
 1. Title sheet, which includes a sheet index, a scaled site plan, an initiating device signaling line circuit address list, a notification appliance circuit chart, a combination parts list/symbol legend, an annunciator zone schedule, and an annunciator legend (where applicable).
 2. Standby power battery calculation(s).
 3. Complete riser diagram.
 4. Complete point-to-point wiring schematics.
 5. Proposed conduit layout plan showing the actual routing of the conduit, the size and specific wires in each segment of conduit, the location of every device, module, and

terminal cabinet (including identification of the initiating device/notification appliance circuit to which each is connected), the address of each addressable device, the location of all partitions, and the name and/or room number of each area or room. Where conduit will be installed within concealed spaces for which no access will be provided, the conduit routing layout must be scalable.

6. Interior elevations of each room where one or more FACP's, FATC's, battery cabinets/chargers, auxiliary power supplies and/or other control devices are located. Include details of manner of installation for any equipment weighing more than 20 pounds.
 7. Voltage drop calculations for each notification appliance circuit. Calculations shall be based on 24 VDC, with high-level volume/level used for horns, and average current used for strobes.
- F. Operation and Maintenance Manuals: Submit two (2) manuals, each of which shall include all instructions necessary for operation and required maintenance of the system, complete circuit diagrams, wiring and termination schedule for each circuit entering and on leaving each piece of equipment, schematic diagrams of each major component, including a replacement parts list with part numbers, name, and telephone number of local supplier. Include any portions of the material list and shop drawings which are not included in the foregoing.
- G. Certification: Provide a Fire Alarm System Record of Completion as per Section 1-6.2.1, NFPA 72 (2016).
- H. Record Drawings: Submit four sets of Record Drawings, which shall be sufficiently complete as to facilitate trouble shooting and repair of the system, as follows: one (1) set shall be black-line Mylar reproducible, two (2) sets shall be blue-line (or equal) reproduction copies, and one (1) set shall be on an MS-DOS-formatted CD-ROM in AutoCAD, Release 14 (or higher) ".DWG" format with no "X-Refs". Final approvals are subject to receipt of acceptable Record Drawings. In particular, the Drawings shall identify every change of wiring/conduit direction accomplished by other than bending, including, but not limited to: junction boxes, pull boxes, "LB"s, "LL"s, "LR"s, entrance "L"s. Submittal of a single blue-line (or equal) reproduction draft copy for review prior to the final submission is encouraged. Provide two copies of the MS-DOS-formatted CD-ROM containing the backed-up programming as required.

1.05 QUALITY ASSURANCE

- A. Installer and Fabricator Qualifications:
1. The system contractor shall hold a current California C-10 contractor's license, and shall have held this license, under the currently-licensed business name, for a period of not less than five years as of the date of bidding the job.
 2. Submit evidence of the system contractor's current California C-10 contractor's license and list of minimum three comparable installations completed within the last five years.
 3. The system contractor shall demonstrate satisfactory installations of comparable systems over a period of not less than five years immediately preceding the date of bidding this job, including references (name, email and telephone no.)
 4. The system contractor shall be a factory-authorized distributor of the manufacturer of the specified FACP, and shall have been so continuously for a period of not less than five years as of the date of bidding the job. Additionally, the system contractor shall employ design personnel and installation technicians who have been factory-trained on the specified FACP.

5. The system contractor shall prove the ability to provide emergency restoration service within 12 hours by factory-certified personnel.
 6. The system contractor shall be capable of providing drawings in AutoCAD, Release 14 (or higher), format.
- B. The system specified herein and as described on the Drawings (including but not limited to materials, design, installation and testing) shall be provided by a single contractor, identified hereafter as the "system contractor," qualified as described below.

1.06 COORDINATION

- A. The Contractor shall be specifically responsible for ensuring that no system components (including but not limited to: conduit, wire, terminal cabinets, junction boxes and/or device boxes) shall be installed prior to their having been detailed on approved shop drawings. The Contractor shall be specifically responsible for ensuring that coordination between the system work and the fire protection system work takes place to ensure full awareness of the location of all fire protection system components (including, but not limited to control valves, flow switches and tamper switches) requiring connection to the system. Further, the Contractor shall be specifically responsible for ensuring that coordination between the system work and other work takes place to ensure full awareness of the location of all components/devices requiring connection to the system (including, but not limited to: fan and smoke control system controls/devices, magnetic door hold-open release relays, and automatic-closing doors).

PART 2 PRODUCTS

2.01 GENERAL SYSTEM REQUIREMENTS

- A. The Contractor shall furnish and install a complete supervised microprocessor-controlled, intelligent reporting fire detection and alarm system consisting of one or more FACPs, FATCs, initiating devices, notification appliances, relay modules, FATCs, batteries and battery cabinets, annunciator panels, metallic conduit, boxes, wiring, and other components as required for a functional system.

2.02 MANUFACTURERS

- A. Equipment shall be manufactured by Simplex (to match College standard). All major equipment (including, but not limited to initiating devices, notification appliances, and control elements) shall be the product of the manufacturer of the FACP.
1. Exception: Provide College's standard devices where specified or required.

2.03 FIRE ALARM CONTROL PANEL

- A. The fire alarm control panel shall be manufactured by Simplex to match College standard, capable of meeting the performance requirements herein. It shall contain a microprocessor based central processing unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, annunciators, and other system controlled devices.
- B. Function: The main FACP shall perform the following functions:

1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
2. Supervise all initiating device, notification appliance, power, control, and signaling circuits throughout the facility by way of connection to monitor and control modules.
3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
4. Visually and audibly annunciate any trouble, supervisory or alarm condition on operator's terminals, control panel display, and annunciators.
5. Code Generator: The FACP shall incorporate a solid-state audible signal code generator capable of generating the three-pulse temporal pattern (as defined in ANSI S3.41/ISO 8201) signal.

C. System Capacity and General Operation:

1. The FACP shall provide, or be capable of expansion, to not less than 127 intelligent/addressable devices per loop and not less than 254 annunciation points per system.
2. The FACP shall include a full featured operator interface control and annunciation unit that shall include a backlit, 80 character liquid crystal display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the FACP.
4. The FACP shall be able to provide the following features:
 5. Block Acknowledge.
 6. Charger Rate Control.
 7. Control-By-Time.
 8. Automatic Day/Night Sensitivity Adjust.
 9. Device Blink Control.
 10. Drift Compensation.
 11. Pre-alarm Control Panel Indication.
 12. NFPA 72 Smoke Detector Sensitivity Test.
 13. System Status Reports.
 14. Alarm Verification, by device, with tall.
 15. Multiple Printer Interface.
 16. Multiple CRT Display Interface.
 17. Non-Alarm Module Reporting.
 18. Periodic Detector Test.
 19. Trouble Reminder.
 20. Upload/Download to PC Computer.
 21. Alarm Verification with Tally.
 22. Walk Test.
 23. Smoke Detector Maintenance Alert.v

D. Enclosures:

1. The Mass Notification panel shall be housed in a UL-listed cabinet suitable for surface mounting. The cabinet and front shall be corrosion protected and painted red via the powder coat method with manufacturer's standard finish.

2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
 3. The door shall provide a key lock and shall provide for the viewing of all indicators.
- E. Central Processing Unit (CPU):
1. The CPU shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the CPU.
 2. The CPU shall contain and execute all control-by-event (including AND-ing, OR-ing, NOT-ing, CROSSZONE-ing) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
 3. The CPU shall provide a real-time clock for time annotation of all system displays. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
- F. Display:
1. The system display shall provide all the controls and indicators used by the system operator and may be used to program all system operational parameters.
 2. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
 3. The system display shall provide an 80-character back-lit alphanumeric liquid crystal display (LCD). It shall provide light-emitting-diodes (LEDs) that will indicate the status of the following minimum system parameters: AC POWER, SYSTEM (FIRE) ALARM, and SYSTEM TROUBLE.
 4. The system display shall provide a touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. A minimum of two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.
 5. The system display shall include the following minimum operator control switches: (ALARM) ACKNOWLEDGE, SIGNAL (ALARM) SILENCE, and (SYSTEM) RESET.
- G. Signaling Line Circuit (SLC) Interface Board:
1. Each SLC board shall monitor and control a minimum of 127 intelligent addressable devices. This includes analog detectors (ionization, photoelectric, or thermal), monitor, and control modules.
 2. The SLC interface board shall contain its own microprocessor, and shall be capable of operating in a local mode (any SLC input activates all or specific SLC outputs) in the unlikely event of a failure in the main CPU of the control panel.
 3. The SLC interface board shall not require any jumper cuts or address switch settings to initialize SLC operations.
 4. The SLC interface board shall provide power and communicate with all intelligent addressable detectors and modules connected to its SLC on a single pair of wires. The SLC shall be capable of operation as NFPA Style 4 or Style 6, and capable of near-NFPA Style 7 operation using isolator modules.
 5. Each SLC interface board shall be able to drive at least one Class A (NFPA Style 6) circuit capable of communicating with a device at least 2,500 feet from the FACP, and capable of communicating over a total of 10,000 feet of wire.

6. The SLC interface board shall receive analog information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
- H. Serial Interface Board:
1. A serial interface board shall provide an EIA-232 interfaces between the FACP and the UL Listed electronic data processing (EDP) peripherals.
 2. The serial interface board shall allow the use of multiple printers, CRT monitors, and other peripherals connected to the EIA-232 ports.
 3. The serial interface board shall provide at least one EIA-485 port for the serial connection to annunciation and control subsystem components.
 4. The serial interface board shall have LEDs that will show that it is in regular communication with the annunciators or other EIA 485 connected peripheral device.
 5. EIA-232 serial output circuits shall be optically isolated to assure protection from earth ground.
- I. Enclosures:
1. The FACP shall be housed in a UL Listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
 2. The back box and door shall be constructed of minimum 0.060-inch steel with provisions for electrical conduit connections into the sides and top.
 3. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left side (field selectable).
 4. The control panel shall be modular in structure for ease of installation, maintenance, and future expansion.
- J. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
- K. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL Standard 864.
- L. Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.
- M. Main Power Supply (MPS):
1. The MPS shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
 2. The MPS shall provide a minimum of 3.0 amps of usable notification appliance power, using a switching 24 VDC regulator.
 3. The MPS shall be expandable for additional notification appliance power in minimum 3.0 amp increments.

4. The battery charger portion of the MPS shall be UL Listed as having the capacity to maintain the battery fully charged with automatic rate change.
 5. The MPS shall provide a very low frequency sweep earth detect circuit, or an approved equivalent means, capable of detecting earth faults on sensitive addressable modules.
 6. The MPS shall be power-limited using positive temperature coefficient resistors or an approved equivalent means.
 7. The above requirements apply equally to any supplementary and/or auxiliary power supplies determined necessary to fully power the system, as well as to the annunciator power supply.
- N. System Circuit Supervision:
1. The FACP shall supervise all circuits to intelligent devices, annunciators and conventional peripherals and annunciate loss of communications with these devices. The CPU shall continuously scan the above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate that device or devices are not responding.
 2. Sprinkler system control valves, standpipe control valves, post indicator valves, and main gate valves shall be supervised for off-normal position.
- O. Field Wiring Terminal Blocks: For ease of service all wiring terminal blocks shall be the plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks permanently fixed are not acceptable.
- P. Municipal Tie Modules: A reverse-polarity module shall be provided for transfer of system alarm and trouble signals to the CAMPUS Fire Alarm Monitoring Station via campus fire alarm proprietary cable plant, with connection point at the main FATC. The contractor shall coordinate connection of this function with the College's Representative.
1. The normal polarity output current of the module shall be interrupted on all trouble (including supervisory) conditions, including loss of AC power, without reliance on batteries or other secondary power sources. The output polarity shall reverse on all alarm conditions and shall supersede any output current interruption due to trouble conditions. A remote station disconnect switch is required which, when operated, shall interrupt the output current irrespective of alarm conditions.
- Q. Field Programming:
1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
 2. All programming shall be accomplished either through the standard FACP keyboard or using DOS-based or Microsoft Windows-based software on a standard PC-compatible laptop computer.
 3. All field-defined programs shall be stored in non-volatile memory.
 4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. A minimum of two levels of password protection shall be provided. One level shall be used for status level changes such as zone disable or manual on/off commands. A second (higher level) shall be used for actual change of program information.

5. System programming shall be "backed-up" on one or more MS-DOS formatted CD-ROMs. This system back-up shall be capable of download to a replacement FACP should the system be damaged due to fire or other event.
- R. Specific System Operations:
1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.
 2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification function shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification during the field programming of the system or anytime after system turn-on. Alarm verification shall not require any additional hardware to be added to the control panel. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
 3. System Point Operations:
 4. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad.
 5. System output points shall be capable of being turned on or off from the system keypad.
 6. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
 7. Device Status.
 8. Device Type.
 9. Custom Device Label.
 10. Software Zone Label.
 11. Device Zone Assignments.
 12. Analog Detector Sensitivity.
 13. All Program Parameters.
 14. System History Recording and Reporting: The FACP shall contain a history buffer that shall be capable of storing not less than 400 system output/input/control activations. Each of these activations shall be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed. Contents of history buffer shall be manually reviewable, one event at a time, and the actual number of activations shall be capable of being displayed.
 15. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
 16. Automatic Detector Maintenance Alert: The FACP shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
 17. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system shall enter the trouble mode, and the particular intelligent detector shall be annunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

18. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80 percent of its alarm threshold.
19. Battery Charge/Transfer Module: Loss or brown-out of main power to the system shall automatically cause the system to transfer to battery power. Emergency power conditions shall be indicated by a lamp and audible annunciator. Upon return of system power, the control panel shall recharge batteries to full capacity within 48 hours following a discharge cycle as specified in 2.13 herein, and maintain battery on float charge thereafter. The charger shall be UL Listed as having the capacity to maintain the battery fully charged with automatic rate change.

2.04 MANUAL FIRE ALARM STATIONS

- A. Manual fire alarm stations shall be rectangular, with a white "T" handle, the handle to pull out and down in an arc with a bottom pivot; single-pole single-throw gold-plated contacts with circuit connections via terminal block; operated stations to be readily distinguishable from front or side, reset to be accomplished with the College standard key. Stations must be designed so that after an actual activation, they cannot be restored to normal except by key reset. Manual stations shall be red with white-finished raised "FIRE ALARM" lettering, and shall be designed for semi-flush mounting, with the exception of the manual stations for use in locations requiring weatherproof devices, which shall be designed for surface mounting.
- B. Manual stations shall be push double action type or lift and pull double action type.

2.05 SMOKE DETECTORS

- A. Smoke detectors shall be intelligent addressable devices, and shall connect with two wires to an SLC.
 1. Exception: Beam smoke detectors may be conventional devices, provided with monitoring modules and power supervision.
- B. The detectors shall use the photoelectric (light-scattering) principle to measure smoke density and shall, on command from the control panel, send data to the control panel representing the analog level of smoke density.
- C. The detectors shall be ceiling-mount and shall include a twist-lock base.
- D. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
- E. The detectors shall provide an address-setting means using decimal or binary (DIP) switches on the detector head or base. The detectors shall store an internal identifying code that the control panel shall use to identify the type of detector.
- F. The detectors shall be provided with at least one alarm/power LED. The LED(s) shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. The LED(s) may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LED(s) shall be controlled through the system field program. An output connection shall be provided in the base to connect an external remote alarm LED. Remote alarm LEDs shall provide, in a unit capable of installation in a single-gang backbox, a remote visual indicator of alarm status of a connected detector.

- G. The detector sensitivity shall be set through the FACP, adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the control panel on a time-of-day basis.
- H. Using software in the FACP, the detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be UL Listed as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
- I. The detector shall be available with bases with internal sounders, which, upon receipt of a command from, or supply of power from the FACP, shall generate a continuous audible alarm.

2.06 SYSTEM HEAT DETECTORS

- A. Heat detectors shall be intelligent addressable devices, and shall connect with two wires to an SLC.
- B. The detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the FACP, send data to the control panel representing the analog level of such thermal measurements.
- C. The detectors shall be ceiling-mount and shall include a twist-lock base.
- D. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the FACP. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the FACP.
- E. The detectors shall provide an address-setting means using decimal or binary (DIP) switches on the detector head or base. The detectors shall store an internal identifying code that the control panel shall use to identify the type of detector.
- F. The detectors shall be provided with at least one alarm/power LED. The LED(s) shall flash under normal conditions. In certain applications, the LED(s) may be selected to be polled without flashing through system programming. The LED(s) may be placed into steady illumination by the FACP, indicating that an alarm condition has been detected.
- G. An output connection shall be provided in the base to connect an external remote alarm LED.

2.07 MONITOR MODULES

- A. Each monitor module shall be capable of monitoring one supervised Style D (Class A) Initiating Device Circuit (IDC) consisting of one or more of conventional alarm initiating devices (any N.O. dry contact device).
- B. Monitor modules shall have integral mounting brackets, and be capable of being mounted in a 5-inch square, 2.125-inch deep electrical box or surface-mounted backbox. Screw terminals shall be provided for connections to the SLC and the device(s) being monitored.
- C. The monitor module shall provide address-setting means using decimal or binary (DIP) switches and shall store an internal identifying code that the FACP shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- D. For connection to shorting-type manual fire alarm stations, monitor modules shall be available in a miniature package capable of being installed within a single-gang box in conjunction with a manual pull station. This version does not require an LED.

2.08 CONTROL MODULES

- A. Addressable control modules shall be capable of supervising and controlling the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized audible/visual notification appliances. In addition, for fan shutdown and other auxiliary control functions, the control module shall be capable of operating as a dry contact relay.
- B. Control modules shall have integral mounting brackets, and be capable of being mounted in a 5-inch square, 2.125-inch deep electrical box or surface-mounted backbox. Screw terminals shall be provided for connections to the SLC and the device(s) being controlled.
- C. Control modules shall be capable of being wired for a Style Z (Class B) NAC (up to 1 amp of inductive audible/visual notification appliance, or 2 amps of resistive audible/visual notification appliance) operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100 percent of all auxiliary relay or NACs are energized at the same time on the same pair of wires.
- D. The control module shall provide address-setting means using decimal or binary (DIP) switches and shall store an internal identifying code that the FACP shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.
- E. The control module shall incorporate a magnetic test switch to test the module without opening or shorting its NAC wiring.

2.09 ISOLATOR MODULES

- A. Line-powered isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC. See 3.2.1.7 for required isolator module installation.
- B. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section of the SLC. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
- C. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
- D. Isolator modules shall have integral mounting brackets, and be capable of being mounted in a 5-inch square, 2.125-inch deep electrical box or surface-mounted backbox. Screw terminals shall be provided for connections to the SLC and the device(s) being monitored.

2.10 NOTIFICATION APPLIANCES

- A. Combination Audible/Visual Notification Appliances:
 - 1. The audible portion of the combination audible/visual notification appliances shall be 24 VDC polarized, electronic horns. Rated reverberant output of the appliance shall be not less than 82 dBA at 10 feet when measured in accordance with UL 464 at nominal input voltage. Housings shall be white with red "FIRE" lettering.

2. The visual indicating portion of such combination appliances shall be 24 VDC polarized xenon tube stroboscopic devices, with minimum effective intensity not less than 15 candela per UL 1971 and a near-axis intensity of not less than 75 candela (light intensity not less than 117 candela per UL 1638 for exterior devices), light source color clear or nominal white, flash rate not less than 1 Hz nor more than 3 Hz, integrally mounted on the audible device. These appliances shall be compatible with, and capable of being connected in a Style Z (Class A) synchronization scheme.
- B. Visual-only notification appliances shall be 24 VDC polarized xenon tube stroboscopic devices, with minimum effective intensity not less than 15 candela per UL 1971 and a near-axis intensity of not less than 75 candela (light intensity not less than 117 candela per UL 1638 for exterior devices), light source color clear or nominal white, flash rate not less than 1 Hz nor more than 3 Hz, of the same manufacturer as the combination audible/visual notification appliances. These appliances shall be compatible with, and capable of being connected in a Style Z (Class A) synchronization scheme. Housings shall be white with red "FIRE" lettering.
 - C. Building location strobe lights shall be UL Listed for outdoor use, 24 VDC polarized devices, xenon tube, with red lens, flashing rate not to exceed 2 Hz. Light output shall be UL Listed for not less than 8.0 candela/seconds.
 1. Location Lights: Amseco, Model SL-524R, or equal (no known equal).

2.11 VISUAL ANNUNCIATOR

- A. The annunciator shall be exterior, weatherproof, tamperproof, with a hinged door. It shall be of one of the following two styles:
 1. Red cottage style construction, with a keyed lock, provided with weatherproof "bullseye" annunciator indicating lamps and holders with clear or white lenses of not less than 0.6875 inches in diameter. Lamps shall be 24 or 28 VDC, 3.0 minimum spherical candlepower, 0.170 amp rated current, 250 hours minimum rated life, red-colored (No. 313R or equal). The annunciator shall have a lamp for each required zone (see 3.2.7) plus a minimum of 10 percent (but not less than four) spare indicating lights. Wiring shall terminate on terminal blocks. Where control panel zones are to be combined to a reduced number for the annunciator, provide diode matrix at FACP to accomplish. Exterior finish shall be suitable for coastal environment.
 2. An analog display having a separate lamp or LED for each required zone (see 3.2.7) plus a minimum of 10 percent (but not less than four) spare lamps or LEDs, installed within a NEMA 4X enclosure provided with a window cover of sufficient size to permit observation of the entire display. The front of the enclosure shall either be hinged and provided with a lock keyed as per 2.15, hinged and secured with screws, or have a front entirely secured with screws. Remote annunciators which require operation of controls to see alarms on multiple zones are not acceptable.
- B. Lamp power for the annunciator shall be supplied by separate power supply with FACP-monitored power-on supervision. This supply shall be independent of FACP ground-fault supervision. Power supply, including charging circuitry and batteries, shall meet the requirements specified for FACP power supplies.
- C. Legends for annunciators as per 2.11.1.1 shall be permanently-engraved 0.125-inch minimum thickness plastic laminate—red in color with black lettering. Lettering shall be san-serif block style, all uppercase, 0.375-inch high minimum. Attach legends using double-sided tape with tamper-resistant screws at each corner.

1. During construction, the contractor shall ensure that the system supplier/designer coordinate requirements with the CALIFORNIA STATE Fire Marshal to provide a system fully-compliant with this specification.

2.12 FIRE ALARM TERMINAL CABINETS AND TERMINALS

- A. The main fire alarm terminal cabinet shall have a minimum depth of 6 inches; all others shall have a minimum of 4-inch depth. All shall have full-face doors with integral, permanently-attached hinges and integral locks; have 0.75-inch deep fire retardant treated plywood (or integral formed steel) backboards; and be sized to allow neat wire and terminal installation. The main FATC shall be of such a size to leave a minimum clear backboard space 8 inches wide by 18 inches high at one side after installation of terminal strips, wiring, and any other devices/equipment.
 1. Exception: Auxiliary FATCS (FATCS other than the main FATC or floor FATCS, containing modules and/or terminal blocks) in locations not readily accessible to the public (e.g., above ceilings, in locked electrical or mechanical rooms, above 8 feet a.f.f., etc.) Need only be provided with a positive means of latching.
- B. Terminal blocks to be pressure plate box type, 300 volt medium duty, rated for No. 22 through No. 10 solid and stranded wire, polypropylene, dovetail base, tubular clamp, mounted on prepunched aluminum channel: Buchanan P0625 Terminals with P0630 end sections, No. 68 clamps, and No. 67 channel, or equal (no known equal).

2.13 BATTERIES

- A. Batteries shall be rated for the capacity to operate the system in a full supervisory mode with AC power removed for 24 hours followed by operation of all notification appliances for 5 minutes. Batteries shall be lead-calcium, sealed, maintenance-free type.
 1. The calculations done to determine the size batteries necessary to meet this requirement should be accomplished in accordance with the recommendations of the battery manufacturer with regard to the effects of applying a high-current load after a long period of low-current load. Regardless of the method used for the calculations, and/or the battery size(s) shown on approved shop drawings, the system contractor is responsible for providing batteries with the capacity required to successfully demonstrate compliance with this requirement.
 2. The above requirements apply equally to any batteries associated with supplementary and/or auxiliary power supplies determined necessary to fully power the system, as well as to the annunciator power supply.

2.14 BATTERY CABINETS

- A. Each battery cabinet shall be a separate, locking cabinet manufactured for the purpose.

2.15 CABINET LOCKS

- A. Cabinet locks, including FACPs, battery cabinets, FATCs, and annunciators shall be keyed to the College standard.
 1. Exception: auxiliary FATCS (FATCS other than the main FATC or floor FATCS, containing modules and/or terminal blocks) in locations not readily accessible to the public (e.g., above ceilings, in normally-locked electrical or mechanical rooms, above 8 feet a.f.f., etc.) need only be provided with a positive means of latching.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install equipment in compliance with manufacturer's written recommendations and installation instructions.
- B. Locate and install conduit, devices, equipment, and accessories as specified. FACP's shall be located in approved electrical rooms.
 - 1. Mount FACP's, FATC's, and any other control equipment such that terminals are located between 42 and 66 inches above the adjacent walking surface.
 - 2. Center manual pull stations 48 inches above finished floor.
 - 3. Install backboxes for all notification appliances with the bottom 80 inches above finished floor, or 10 inches below finished ceiling, whichever is lower.
 - 4. Install backboxes for remote alarm LED/test stations and remote alarm LEDs with the bottom 80 inches above finished floor. Install on the strike side of the door of the room/space within which a smoke, heat, or duct smoke detector is located. If, for any reason, the remote alarm LED/test station cannot be mounted on the wall immediately adjacent to the door, provide a durable printed label on the remote alarm LED/test station identifying the room number of that room.
 - 5. Install visual annunciators at a height of 54 to 60 inches from finished grade to bottom of housing, adjacent to fire access lanes, as shown on the drawings. If pedestal-mounted, provide an engraved legend firmly attached to the pedestal with tamper proof screws. Specific locations to be approved by the CALIFORNIA STATE Fire Marshal and the College's Representative.
 - 6. The main FATC shall be located immediately adjacent to the FACP. The underground conduit for CAMPUS Fire Alarm Monitoring Station connection shall be extended to this cabinet.
 - 7. There shall be no cabinets or equipment installed below a battery cabinet.
 - 8. All conduit, devices, and equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Smoke detectors shall not be supported solely by suspended ceilings. Fasteners and supports shall be adequate to support the required load.
 - 9. All equipment and devices installed in exterior or other locations exposed to the outside environment shall be approved and UL Listed for such application, or shall be installed in a NEMA 4X enclosure. All conduit, fittings and hardware shall be corrosion resistant rigid type.
 - 10. All modules (e.g., monitor modules, control modules, signal modules, and isolator modules) shall be installed within an FATC, mounted in an appropriately-sized backbox.
 - 11. Exception: Miniature monitor modules may be installed within interior or weatherproof exterior manual fire alarm station backboxes.
 - 12. Equipment installed in flammable or explosive atmospheres shall be approved and UL Listed for such application. All raceway and fittings shall be installed in accordance with the California Electrical Code for hazardous (classified) locations.
 - 13. Provide a lockdown clip for each circuit breaker supplying power to system components. Circuit breakers shall be permanently and clearly identified at the circuit breaker panel by red marking and shall be identified as "FIRE ALARM CIRCUIT." Additionally, the location and designation of the circuit breaker panel, and the circuit breaker number(s) shall be permanently and clearly identified at the powered system component.

14. Door holders shall hold door open until smoke has been detected by the smoke detector(s) provided. When actuated, the device shall release door to close and shall release automatically on power failure. Door holding devices shall NOT be connected to battery supply.
 15. Building location strobe lights shall be located on the exterior of the building so as to be visible from the fire access lanes, as determined by the CALIFORNIA STATE Fire Marshal. They shall be securely mounted atop a section of rigid conduit so as to be 4 feet above the roof edge at the specified location, unless otherwise noted on the drawings or directed by the CALIFORNIA STATE Fire Marshal. They shall be powered by an independent notification appliance circuit and shall operate continuously when the FACP is in an alarm condition.
 16. Penetrations of fire-rated construction shall be firestopped using an approved, listed through-penetration firestop system as specified in Division 7 Section "Firestopping."
 17. Auxiliary power required by any device shall be 24 VDC, provided and supervised by the FACP in such a manner as to be identified separately from any other trouble condition.
 18. FACP batteries shall be installed in battery cabinets as per 2.14.
 19. Weatherproof manual stations shall be installed as surface-mounted devices, attached to the wall by screws through the pre-cast holes in the backbox only; no additional holes may be drilled. If entry into the box is from the rear, using the knockout provided, the foam gasket provided with the manual station must be used. Regardless of whether entry is through the top, bottom, or rear, it must be by conduit.
 20. Exception: when the rear knockout is used for entry, conduit may terminate at a single-gang outlet box, with the weatherproof backbox then installed using screws through the pre-cast holes. A knockout bushing is required.
- C. System wiring shall conform to the following requirements:
1. All wire shall be new.
 2. Minimum wire size shall be No. 12 AWG (No. 14 AWG permitted for IDC and NAC wiring not exceeding 25 VDC; No. 18 AWG permitted for SLC wiring), type THWN, 600 volt, solid copper. Wire size shall be increased as required to maintain voltage and current capacity. Voltage drop shall not exceed manufacturer's listing for NACs, but shall in no case exceed 10 percent.
 3. Spare conductors shall be provided on a 10 percent (minimum two conductor) schedule per riser; annunciator panels shall be wired for full capacity, plus a minimum of six (6) spare conductors.
 4. All system circuits (including, but not limited to initiating device, notification appliance, signaling line, power, and relay circuits) shall be run above-grade and/or overhead (i.e., there shall be no system circuit wiring in or below floor slabs).
 5. Exception: visual annunciator circuit wiring and post indicator valve tamper switch circuit wiring.
 6. Wiring shall be continuous from FATCs to other FATCs, field devices and to the FACP. Splicing (whether in terminal boxes, junction boxes, device boxes, or below-grade) shall not be permitted. Parallel branches ("T" taps) are not permitted regardless of the method of supervision employed.
 7. Exception: devices available only with "pig-tail" connections shall be connected to the circuit wiring using approved insulated wire nuts.
 8. Only those wires directly serving a duct detector shall be routed through its housing.
- D. Terminal cabinets shall be provided and configured to conform to the following requirements:

1. All field wiring and FACP wiring shall be terminated in FATCs or on field devices.
 2. There shall be at least one FATC for each floor (the main FATC may serve as the floor FATC for the floor on which it is located).
 3. All system wiring shall be terminated in the main FATC. In addition, the wiring for each floor shall be terminated in that floor's FATC prior to entering and returning from the field.
 4. All connections shall be made on terminals. There shall be one electrically independent terminal block segment for each conductor.
 5. Circuit completions shall be accomplished with cross-connect jumper wires, 2 inches to 3 inches long, between pairs of vertically-oriented terminal blocks. All field device wiring shall terminate on the right-hand terminal strip; FACP wiring shall terminate on the left-hand terminal strip.
 6. Exception: in an FATC other than the main FATC or a floor FATC, the second terminal block and cross-connect jumpers may be omitted.
 7. Terminal blocks shall be permanently identified with a sequential numbering scheme. All wires (with the exception of cross-connect jumpers) shall be identified with their corresponding terminal blocks with substantial markers.
 8. There shall be 10 percent spare sets of terminals, minimum of 12 sets, installed in each main and floor FATC.
 9. A minimum clear backboard space 8 inches wide by 18 inches high at one side shall be provided in the main FATC after installation of terminal strips, wiring, and any other devices/equipment.
 10. All relays and other components carrying 120 VAC (e.g., for door holder circuits) shall be in separate FATCs from those containing the low-voltage system circuitry and/or components.
 11. Exception: such components may be installed within system FATCS if installed in separate enclosures labeled "caution--120 VAC" within them, with all 120 VAC wiring in conduit within the system FATC.
 12. Terminal cabinets shall be hinged on the side farther from the FACP.
- E. Conduit shall be provided and configured to conform to the following requirements:
1. All wiring shall be in metal conduit, concealed in interior locations, except that Schedule 40 PVC conduit shall be used underground. Minimum conduit size shall be 0.75-inch. EMT conduit shall be used in all above-ground locations, except that rigid steel conduit (PVC-coated where indicated below) shall be used in the following locations:
 2. Where required by code.
 3. In electrical, mechanical, and machine rooms.
 4. Where exposed to weather (PVC-coated).
 5. Where exposed and below 7 feet 6 inches above finished floor.
 - a. Exception: Occupied or finished spaces.
 6. Where in slabs or in concrete (PVC-coated).
 7. Where exposed to physical damage.
 8. In corrosive areas (PVC-coated).
 9. In damp or wet locations (PVC-coated).
 10. All system wiring shall be installed in conduit independent of all other electrical circuits.
 11. All styles of Class A circuits (initiating device, signaling line, and notification appliance circuits) shall be wired without parallel branches, with return conductors separate (i.e., in

separate conduit) from outgoing conductors, and are to start at and return to the main FATC. Conduit containing outgoing conductors shall be physically separated from conduit containing return conductors by not less than 12 inches horizontally; there is no separation requirement for vertical conduit.

12. Conduit containing outgoing conductors and conduit containing return conductors separated by a wall of not less than one-hour fire-resistive construction may be spaced closer.
 13. Outgoing and return conductors may be routed through the same conduit for a distance of not more than 10 feet to an initiating device, notification appliance, or control panel enclosure.
 14. Initiating device circuits and signaling line circuits shall be installed in separate conduit from notification appliance circuits. No circuit shall pass through a device mounting box, J-box, pull-box, or any other component of any other circuit.
 15. Exception: for risers connecting floor FATC's, initiating device circuits, signaling line circuits, and notification appliance circuits may be installed in the same conduit.
 16. Maximum conduit fill shall be 75 percent of that permitted by the California Electrical Code.
 17. All system conduit shall be red color--All junction box covers shall be externally identified by permanent red paint suitable for the purpose.
 - 18.
 19. Conduit containing auxiliary circuit wiring as defined in 1.2.2 are not to be so identified.
 20. Magnetic door holding circuits and other non-power limited circuits shall be in separate raceway.
 21. Exposed flexible conduit, as used for attachment to waterflow and valve tamper switches or similar applications, shall be liquid-tight and shall be the minimum length required for neat and secure installation. Flexible conduit lengths shall not exceed 3 feet. Flexible conduit shall not be buried nor located closer than 12 inches to grade.
 22. Conduit shall be arranged such that only those wires directly serving a duct detector are routed through its housing.
 23. Conduit shall not penetrate shaft walls nor be routed within shafts unless serving system components located within the shaft. Where a system component is located within a shaft, wiring to it shall be by means of a single conduit as permitted by Exception.
- F. Signaling Line Circuits (SLCs) and initiating devices shall be installed to comply with NFPA 72 and the following requirements:
1. Smoke detector quantity and spacing shall be as recommended by the manufacturer and NFPA. Smoke detectors shall not be located in a direct airflow nor closer than 3 feet from an air supply diffuser.
 2. Install manual stations in 4S deep boxes with single-gang rings whenever miniature monitor modules will be contained within the box.
 3. Exception: manual stations as per 2.3.3 shall be surface-mounted, with wiring entering the supplied backbox via conduit into the provided threaded knock-out only. The backbox shall be secured via screws through the through-holes provided; no additional penetrations of the backbox shall be made.
 4. Provide wiring and connections to devices (such as, but not limited to: fire sprinkler waterflow switches, valve tamper switches, and waterflow alarm bells; duct smoke detectors; electrically-actuated smoke dampers; and roll-down fire door releasing devices) installed by other work.

5. Duct smoke detectors for closure of smoke/fire dampers shall be installed in accordance with manufacturer's installation instructions, within 5 feet of the smoke/fire damper, on the duct on the same side of the floor or wall as the smoke/fire damper actuator. Install duct detectors on the vertical sides of horizontal ducts only. Any required auxiliary power shall be 24 VDC provided and supervised by the FACP in such a manner as to be identified separately from any other trouble condition.
 6. Exception: with advance approval from the CALIFORNIA STATE Fire Marshal, duct smoke detectors may be installed on the duct on the opposite side of the wall or floor from the smoke/fire damper actuator.
 7. Smoke or heat detectors located within concealed spaces (e.g., duct detectors located above the ceiling, in interstitial spaces, etc.) or in other areas not readily accessible (e.g., installed on roof-mounted air handling equipment, above 8 feet A.F.F., etc.) shall be provided with readily-accessible remote alarm LED/test stations located as per 3.1.1.4 in an approved location. Smoke or heat detectors located within rooms/spaces shall be provided with readily-visible remote alarm LED located as per 3.1.1.4 in an approved location.
 8. Remote alarm led/test stations connected to duct detectors for closure of smoke/fire dampers in corridor walls required to be of fire-resistive construction shall be installed in the corridor, regardless of which side of the wall the detector is actually located on.
 9. Duct smoke detectors shall be installed in accordance with the manufacturer's written installation instructions, especially those portions having to do with required air differential pressure (see 3.6.12). Detectors failing the air pressure differential testing shall be relocated as necessary to permit passing the test.
- G. Notification Alarm Circuits (NACs) and notification appliances shall be installed to comply with NFPA 72 and the following requirements:
1. The total of all audible/visual notification appliances on each circuit shall consume no more than 75 percent of the available output current of the notification appliance circuit module to which they are connected. The aggregate current demand of all audible/visual notification appliances shall not exceed 75 percent of the system power supply available for audible/visual devices.
 2. Provide notification appliances in electrical and mechanical equipment rooms.
 3. The System Contractor shall determine the number and location of audible notification appliances necessary to meet the audibility requirements which shall be included in the submittals. Any audible notification appliances shown on the drawings shall be considered as sample locations only and shall be supplemented as required to meet audibility requirements. Tests shall be made to prove that audible notification appliances meet these requirements; additional audible notification appliances required as a result of this test shall be provided and installed without cost to the College.
 4. Audible notification appliances shall be selected and located to provide a minimum sound level of 15 dBA above ambient in all areas and shall be rated for a minimum of 82 dBA at 10 feet on axis with a maximum of 100 dBA. There shall be audible notification appliance installed on each floor within each apartment unit and in similar dwelling units.
 5. Audible notification appliances shall be semi-flush mounted in accordance with their listing.
 6. Every audible notification appliance shall be provided with a visual notification appliance mounted on the audible notification appliance housing. In addition, there shall be a visual notification appliance installed in every sleeping room.

7. The visual notification appliances shown on the drawings shall be considered as sample locations only and shall be supplemented to meet requirements of NFPA 72, 1999, as amended by Part 2, Title 24, California Code of Regulations. If additional visual notification appliances are required to meet these requirements, they shall be provided and installed without cost to the College.
8. An addressable control module shall be provided to supervise and control the operation of each auxiliary notification appliance power supply used in the system.
9. Audible/visual notification appliance power shall be provided by a separate supervised power loop from the main FACP or from a supervised, UL Listed remote power supply.

3.02 GENERAL SYSTEM OPERATION

A. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto a Style 6 (Class A) signaling line circuit equipped with isolator modules as specified herein.
2. Initiation device circuits shall be Style D (Class A).
3. Notification appliance circuits shall be Style Z (Class A).
4. Digitized electronic signals shall employ check digits or multiple polling.
5. A single ground or open on the signaling line circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
6. Alarm signals arriving at the FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
7. The system shall be zoned, by use of isolator modules, in accordance with the following:
 8. By building.
 9. By floor.
 10. By wing or fire area.
 11. At both ends of every underground circuit.
 12. There shall be a minimum of 10 percent spare capacity for additional devices between each pair of isolators/isolation modules.
 13. Resetting of all devices shall be a single operation accomplished at the FACP.
 14. Silencing of an alarm shall not prevent subsequent initiating devices from initiating and indicating an alarm in a non-interfering manner.
 15. During construction, the contractor shall ensure that the system supplier/designer coordinate requirements with the CALIFORNIA STATE Fire Marshal to provide a system fully-compliant with this specification.

B. The system shall be installed and wired with all necessary equipment, wiring, conduit, and hardware to perform all designated functions. Activation of any alarm initiating device shall result in, as a minimum, the following:

1. The System (Fire) Alarm LED shall flash.
2. A local piezo-electric signal in the control panel shall sound.
3. The 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. Activate all notification appliances throughout the building. In buildings so equipped, activate all alarm systems. Unless otherwise approved in advance by the CALIFORNIA

STATE Fire Marshal, all audible notification appliances and all visual notification appliances throughout the building shall be synchronized.

5. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.
 6. Cause annunciation by zone at the visual annunciator.
 7. Transmit an alarm condition to the CAMPUS Fire Alarm Monitoring Station.
 8. Continue the alarm condition until manually reset.
 9. Release all door holders in the building.
 10. Operate building location strobe/annunciator lights (provided with non-coded power) until manually reset (not silenceable).
 11. All alarms originating from smoke detectors (including duct detectors) shall undergo alarm verification (maximum delay: 60 seconds) prior to initiating a general alarm condition.
- C. Activation of any system trouble or supervisory condition shall be indicated audibly and visually at the FACP and shall transmit a trouble signal to the CAMPUS Fire Alarm Monitoring Station.
- D. Activation of a duct smoke detector for closure of a smoke/fire damper shall initiate the closure of the associated damper, as well as initiating an alarm at the FACP.
- E. The visual annunciator shall provide visual indication of an alarm condition of, at a minimum, the following initiating devices:
1. Manual Stations: By floor, wing and fire zone.
 2. Smoke and Heat Detectors: By floor, wing, and fire zone.
 3. Duct Smoke Detectors: By floor, wing, and fire zone.
 4. Sprinkler Waterflow: By floor, wing, and fire zone.
 5. Special System Monitoring: By system (e.g., Halon, Inergen, dry chemical, carbon dioxide).
- F. Operation of the SIGNAL (ALARM) SILENCE switch at the FACP shall deactivate all notification appliances (both audible and visual, except for the building location strobe light[s]). Activation of any other alarm initiating device shall cause them to be reactivated.
- G. Activation of a smoke or heat detector with an associated remote alarm LED shall result in illumination of the alarm LED.

3.03 IDENTIFICATION

- A. Provide identification of equipment and materials.

3.04 GROUNDING

- A. All metallic conduit, cabinets, junction boxes, and exposed non-current-carrying metal parts shall be permanently grounded. A separate No. 10 AWG conductor shall connect a grounding bus bar located in the main FATC to building ground. The bus bar shall be provided with a minimum of five tubular, pressure type screw terminals sized for No. 18 AWG through No. 10 AWG wire. The ground wire for the FACP and the main FATC shall be grounded via the bus bar.

3.05 DOCUMENTATION

- A. Copies of complete as-built installation wiring documentation, internal FACP schematics, and maintenance manuals are to be submitted prior to final acceptance.

3.06 SYSTEM ACCEPTANCE TESTING

- A. Prior to acceptance testing of the system, it shall be tested and adjusted by the contractor under the supervision of a factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.
- B. When the system is complete and operating normally in all respects, the Contractor shall furnish necessary equipment and personnel to perform acceptance testing, as described herein. Acceptance testing shall be accomplished in the presence of the CALIFORNIA STATE Fire Marshal and the Owner's Representative, and at the direction of the CALIFORNIA STATE Fire Marshal. The purpose of the testing is to ensure that all equipment and devices are installed in an approved manner and are performing as specified. Any deficiencies found must be rectified and the system retested.
 - 1. The system contractor shall provide not less than two persons, at least one of whom shall have been personally involved in the installation of the system, and at least one of whom shall have been personally involved in the programming/start-up of the system. In addition, the system contractor shall provide not less than three units of two-way communication equipment capable of communicating between any two points within the building. Finally, the system contractor shall have available for, and to be retained by the CALIFORNIA STATE Fire Marshal a preliminary set of as-built drawings, and at least one copy of the operation manual for the FACP.
- C. Testing will include, but not be limited to, the following:
 - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 - 2. Close each sprinkler system control valve and verify proper supervisory alarm at the FACP.
 - 3. Verify activation of all flow switches.
 - 4. Open initiating device circuits and verify that the trouble signal actuates.
 - 5. Open and short signaling line circuits and verify that the trouble signal actuates.
 - 6. Open and short notification appliance circuits and verify that trouble signal actuates.
 - 7. Ground all circuits and verify response of trouble signals.
 - 8. Check presence and audibility of all notification appliances.
 - 9. Check installation, supervision, and operation of all intelligent smoke detectors.
 - 10. Each of the alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
 - 11. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, alarm verification functionality and similar.
 - 12. With the air handling unit turned on, and all filters and dampers in place, measure the air differential pressure on all duct smoke detectors which use sampling tubes.
 - 13. Verify zones annunciated on the visual annunciator agree with the initiating zone.

14. When any defects are detected, make repairs or install replacement components, and repeat the tests as required.
15. When all other tests have been completed to the satisfaction of the College's Representative, the system shall be continuously operated on battery power for a period not less than 24 hours, immediately followed by a period not less than 5 minutes during which all notification appliances shall operate continuously. The test shall be considered to have been successfully accomplished if all notification appliances operate as specified throughout the 5-minute period.

3.07 DEMONSTRATION AND TRAINING

- A. The Contractor shall provide the services of a system manufacturer's trained and authorized engineer/technician for providing instruction and training to College's personnel in the operation, maintenance and repair of the complete system. The instruction and training shall be held at the College's premises or at an authorized training facility in two sessions of 8 hours each, and shall be provided at no additional cost to the College. "Hands-on" demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. A typewritten "Sequence of Operation" shall be provided.

END OF SECTION

SECTION 31 23 16.13

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for utilities from 5 FEET outside the building to connection point on-site, where indicated on Drawings.

1.02 RELATED REQUIREMENTS

- A. 00 31 00 - Available Project Information: Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 01 41 00 - Regulatory Requirements: Code Compliance.
- C. Section 31 23 23 - Fill: Backfilling at building and foundations.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop; 2018.
- B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012, with Editorial Revision (2015).
- D. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012, with Editorial Revision (2015).
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2017.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Comply with the requirements listed in Section 31 23 23 - Fill.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.06 COORDINATION OF SPECIFICATION REQUIREMENTS

- A. Coordinate these Specification Section requirements with specifications included on Drawings. Comply with more stringent requirements and with those requirements of the authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. For fill materials see Section 31 23 23 - Fill.
- B. For bed materials see Section 31 23 23 - Fill.
- C. General Fill: Subsoil excavated on-site.
- D. Structural Fill: Subsoil excavated on-site.
 - 1. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- E. Concrete for Fill: Lean concrete.
- F. Granular Fill - Gravel: Pit run washed stone; free of shale, clay, friable material and debris.
 - 1. Graded in accordance with ASTM C136/C136M, within the following limits:
 - a. 3/4 inch sieve: 95 to 100 percent passing.
- G. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
 - 1. Grade in accordance with ASTM D2487 Group Symbol GM.
- H. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
 - 1. Grade in accordance with ASTM D2487 Group Symbol SW.
- I. Topsoil: Topsoil excavated on-site.
 - 1. Select.
 - 2. Graded.
 - 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
 - 4. Acidity range (pH) of 5.5 to 7.5.
 - 5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
 - 6. Conforming to ASTM D2487 Group Symbol OH.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Protect plants, lawns, rock outcroppings, and other features to remain.
- E. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.

3.03 TRENCHING

- A. Excavate subsoil required for conduits, storm drain, sanitary sewer, water and gas piping to municipal utilities.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- D. Trenches Parallel to Footings: Do not place the trench below a 1 vertical to 2 horizontal from 9 inches above the bottom edge of the footing and no closer than 18 inches from the face of footing. CBC Section 1809A.14.
- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Cut trenches wide enough to allow inspection of installed utilities.
- G. Hand trim excavations. Remove loose matter.
 - 1. Hand trim for bell and spigot pipe joints.
- H. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- I. Remove excavated material that is unsuitable for re-use from site.
- J. Remove excess excavated material from site.

- K. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- L. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

3.04 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.
- D. Support pipe and conduit during placement and compaction of bedding fill.

3.05 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage installed piping and conduits, or other work.
- D. Systematically fill and compact as as to achieve 90 percent relative compaction without damaging conduit or pipe. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth or as directed by the Geotechnical Report.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Thrust bearing surfaces: Fill with concrete.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 or 95 percent of maximum dry density as applicable for the fill area.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving and similar construction: 95 percent of maximum dry density.
 - 2. At other locations: 90 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping, Conduits, and Duct Bank:

1. Bedding: Use Fill Type SP or SW (ASTM D2487) or SM with sand equivalent of 30 or greater per ASTM D2419, 3 inches thick, compacted to 90 percent..
2. Cover with Fill Type SP, SW, SM, GM per ASTM D2487.
3. Fill up to subgrade elevation.
4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
5. Gas Piping: As required by the Gas Company.

3.07 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1.2 inch from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1.2 inch from required elevations.

3.08 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Control, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556 or ASTM D6938.
- C. See Section 31 23 23 for compaction density testing.
- D. Correct unauthorized excavation at no cost to District.
- E. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("standard Proctor").
- F. If tests indicate work does not meet specified requirements, remove work, replace and retest at no additional cost to District.
- G. Correct areas over excavated by error in accordance with Section 31 23 23 - Fill.

3.09 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

3.10 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Section 01 50 00 - Temporary Construction Facilities and Controls.
- B. Recompect fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 23 23

FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, site structures, and utilities within the building.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop; 2018.
- B. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials; 2006.
- C. ASTM D4829 - Standard Test Method for Expansion Index of Soils; 2011.
- D. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012, with Editorial Revision (2015).
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. DTSC-Clean Fill - California Department of Toxic Substances Control - Clean Imported Fill Material; Current.
- H. Greenbook - Greenbook: Standard Specifications for Public Works Construction; latest adopted edition.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Soil Samples: 10 pounds sample of each type of fill; submit in air-tight containers to testing laboratory.
 - 1. Submit samples directly to Geotechnical Engineer for testing and analysis copy transmittals to Architect and District.

- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.
- E. Compaction Density Test Reports.
- F. Manufacturer's Instructions.
- G. Manufacturer's Qualification Statement.
- H. Specimen Warranty.
- I. Provide proof that all imported materials conform to the requirements of DTSC-Clean Fill Imported Fill Materials for School Sites by proper documentation for the imported materials.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where agreed to.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Subsoil excavated on-site.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches, rocks larger than 4 inches, and debris.
 - 3. Conforming to ASTM D2487 Group Symbol SP, SW, SM, or GM.
- B. Structural Fill: Subsoil excavated on-site.
 - 1. Graded.

2. Free of organic matter, debris, and oversize particles (e.g., cobbles, rubble, etc. that are larger than 3 inches, rocks larger than 4 inches. Fill shall contain at least fifty percent of material smaller than 1/4 inch in size.
3. Imported fill materials: The soil shall be tested for potential contamination in accordance with DTSC-Clean Fill protocols. Submit to Geotechnical Engineer.
 - a. Import sandy soil shall be free of organics, debris and oversize particles (e.g., cobbles, rubble, etc. that are greater than 3 inches in the largest dimension).
 - b. Additionally, import soils shall not have any corrosion impacts to buried concrete; and be non-expansive (Expansion Index less than 50 per ASTM D4829).
 - c. Prior to import, geotechnical consultant shall evaluate and test the import soils in order to confirm the quality of the material.
4. On-site soils should only be used as specified in the Soils Report.
5. Conforming to ASTM D2487 Group Symbol SP, SW, SM, or GM.
- C. Concrete for Fill: As specified in Section 03 30 00; compressive strength of 2500 psi.
 1. Exception: Concrete used under footings and foundations to correct over-excavation shall be same as for footings and foundation.
- D. Granular Fill - Fill Type GM, GW: Coarse aggregate, conforming to Uniform Standard Specifications for Public Works Construction Off-Site Improvements standard.
- E. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
 1. Grade in accordance with ASTM D2487 Group Symbol GM.
- F. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.
 1. Grade in accordance with ASTM D2487 Group Symbol SP or SW.
- G. Topsoil: Topsoil excavated on-site.
 1. Unclassified.
 - a. The soil shall be tested for potential contamination in accordance with DTSC-Clean Fill protocols.
 2. Graded.
 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
 4. Acidity range (pH) of 5.5 to 7.5.
 5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
 6. Conforming to ASTM D2487 Group Symbol OH.
 7. Limit decaying matter to 5 percent of total content by volume.
- H. Type F - Subsoil: Reused, free of rocks larger than 3 inch size, and debris.
 1. Existing fill and alluvium or older alluvium may be considered suitable for re-use as compacted fills provided the recommendations of the geotechnical report and observations of the geotechnical engineer are followed.
 2. Expansive soils (EI>51) are not be placed with the upper 3 feet of subgrade soils

2.02 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, non-woven; Geotex 801 manufactured by Propex Geotextile Systems, geotextile.com.

2.03 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.
- E. Comply with EPA/DTSC-Clean Fill requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify structural or other backfill materials to be reused or imported are acceptable to the satisfaction of the Geotechnical Engineer. Approval shall be obtained in advance of re-use or importation onto the site.
 - 1. The soil shall be tested for potential contamination in accordance with DTSC-Clean Fill protocols.
 - 2. Provide imported fill materials compatible with on-site soils in addition to being suitable for its intended use with the following criterion, as allowed by the Geotechnical Engineer.
 - a. Predominantly granular in nature.
 - b. Containing no rocks larger than 6 inch maximum dimension.
 - c. Free of organic material (loss on ignition less-than 2 percent).
 - d. Very low expansion potential (with an Expansion Index less than 21).
 - e. Low corrosion impact to the proposed improvements.
- B. Verify that survey bench marks and intended elevations for the Work are as indicated.
- C. Identify required lines, levels, contours, and datum locations.
- D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- E. Verify structural ability of unsupported walls to support imposed loads by the fill.
- F. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

- A. Scarify and proof roll subgrade surface to a depth of 8 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Greenbook, Type II or concrete fill and compact to density equal to or greater than requirements for subsequent backfill material.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

- D. Prior to placement of aggregate base course material at paved areas, compact subsoil to 95 percent of its maximum dry density in accordance with 1.
- E. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
 - 1. Place fill soils compacted in horizontal lifts to a relative compaction of 90 percent or more in general accordance with 1.
 - 2. Lift thickness for fill soils will vary depending on the type of compaction equipment used but should generally be placed in horizontal lifts not exceeding 8 inches in loose thickness.
 - 3. Place fill soils at slightly above optimum moisture content as evaluated by 1.
 - 4. Avoid damage to wet and dry utility lines when compacting fill and subgrade materials.
- C. Employ a placement method that does not disturb or damage other work.
 - 1. Do not disturb or damage foundation perimeter drainage and foundation waterproofing and protective cover utilities in trenches.
- D. Systematically fill and compact per geotechnical report. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
 - 1. Expansive soils ($EI > 20$) are not be placed with the upper 3 feet of subgrade soils. CBC Section 1803.5.3.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Load-bearing foundation surfaces: Fill with concrete.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 or 95 percent of maximum dry density in subgrade zone.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 90 percent of maximum dry density.
 - 2. At other locations: 90 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.
- L. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed

unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

M. Remove surplus fill and backfill materials from site.

3.04 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Structural Fill:

1. Use general fill.
2. Fill up to subgrade elevations.
3. Maximum depth per lift: 6 inches, compacted.
4. Compact to minimum 90 percent of maximum dry density.

C. Under Interior Slabs-On-Grade:

1. Comply with CALGreen Section 4.505.2.1 Capillary Break and ACI 302.2R
2. Use granular fill. Type Class 2 Aggregate base or No. 8 or No. 89, 1/2 inch or larger.
3. Depth: 4 inches deep.
4. Compact to 90 percent of maximum dry density.

D. At Footings:

1. Use general fill.
2. Fill up to subgrade elevation.
3. Compact each lift to 90 percent of maximum dry density.
4. Do not backfill against unsupported foundation walls.
5. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

E. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:

1. Drainage fill and geotextile fabric
2. Cover drainage fill with general fill.
3. Fill up to subgrade elevation.
4. Compact to 90 percent of maximum dry density.

F. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:

1. Bedding: Use general fill.
2. Cover with general fill.
3. Fill up to subgrade elevation.
4. Compact in maximum 8 inch lifts to 90 percent of maximum dry density. Compact to 95 percent in subgrade zone.

G. At Planting Areas Other Than Lawns :

1. Use general fill.
2. Fill up to finish grade elevations.

3. Compact to 90 percent of maximum dry density.
 4. See Section 31 22 00 for topsoil placement.
- H. Under Monolithic Paving :
1. Compact subsoil to 90 percent of its maximum dry density before placing fill.
 2. Use general fill.
 3. Fill up to subgrade elevation.
 4. Compact to 90 percent of maximum dry density.

3.05 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1/2 inch from required elevations.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
 1. Laboratory Tests and Analyses: Where backfill is required to be compacted to a specified density, tests for compliance shall be made in accordance with requirements specified in Section 01 40 00 - Quality Requirements.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556 or ASTM D6938.
 1. Field inspections and testing shall be performed and submitted in accordance with requirements specified in Section 01 40 00 - Quality Requirements.
 2. Allow testing service to inspect and approve each subgrade and fill layer before further fill, backfill or construction Work is performed.
 3. Alternate Density Test Method:
 - a. Field density tests may also be performed by the nuclear method in accordance with 2, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using 1.
 - b. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with 2.
 - c. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of Work, on each different type of material encountered, and at intervals as directed by Architect or District's testing and inspection agency.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor") or AASHTO T 180.
- D. Non-compliance: If tests indicate work does not meet specified requirements, remove work, replace and retest.
 1. Should tests of fill or backfill indicate non-compliance with required density, Contractor shall over-excavate, recompact and retest until specified density is obtained.

2. Costs and Time associated with remedial Work and retesting shall be in accordance with provisions of the General Conditions.
 3. Retesting to demonstrate compliance shall be by a testing laboratory acceptable to District and shall be at Contractor's expense.
- E. Frequency of Tests:
1. Footing Subgrade Testing:
 - a. For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities.
 - b. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Geotechnical Engineer.
 2. Paved Areas and Building Slab Subgrade Testing:
 - a. Perform at least one field density test of subgrade for every 2,000 sf of paved area or building slab, but in no case fewer than three tests.
 - b. In each compacted fill layer, perform one field density test for every 2,000 sf of overlying building slab or paved area, but in no case fewer than three tests.
 3. Foundation Wall Backfill Testing: Perform at least two field density tests at locations and elevations as directed.
- F. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

3.07 CLEANING

- A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks and integral curbs.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 07 92 00 - Joint Sealants: Sealing joints.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2016.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- D. ACI 305R - Guide to Hot Weather Concreting; 2010.
- E. ACI 306R - Guide to Cold Weather Concreting; 2016.
- F. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).
 - 1. Use 2014 as indicated in 2016 CBC Ch. 35 Referenced Standards.
- G. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2018.
 - 1. Use 2012 as indicated in 2016 CBC Ch. 35 Referenced Standards.
- I. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2011.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).
 - 1. Use 2013 as indicated in 2016 CBC Ch. 35 Referenced Standards.
- K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.
- L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2018.
 - 1. Use 2014a as indicated in 2016 CBC Ch. 35 Referenced Standards.
- M. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
 - 1. Use 2012 as indicated in 2016 CBC Ch. 35 Referenced Standards.
- N. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

- O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2017.
- P. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.
- Q. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018.
- R. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2011.
- S. SSPWC (Greenbook) - Greenbook: Standard Specifications for Public Works Construction; Current Adopted Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, and curing compound.

1.05 QUALITY ASSURANCE

- A. Lines and Levels: Established by State of California licensed Surveyor or registered Civil Engineer. Costs of surveying services shall be included in the Contract Sum.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

- A. Comply with applicable requirements of ACI 301.
- B. Concrete Sidewalks: 3,000 psi 28 day concrete, thickness as indicated on Drawings, minimum 4 inches, natural grey color Portland cement.

2.02 REGULATORY REQUIREMENTS:

- A. Conform to California Code of Regulations (CCR), Volume 2, Part 2, Chapters 18A and 19A.
- B. Conform to California Building Code (CBC), Volume 2, Chapter 11B and ADA Standards for accessibility requirements.
 - 1. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.
 - 2. Concrete paving and concrete finishes along accessible routes of travel shall be at least as slip-resistant as that described as a medium salted finish for slopes of less than 6%, and slip resistant at slopes of 6% or greater; CBC 11B-403.2.
 - 3. Continuous surfaces, including walks and sidewalks, shall have a continuous common surface, not interrupted by steps or by abrupt changes in level exceeding 1/4 inch vertical (CBC 11B-303.2), or beveled at 1:2 slope to a maximum height of 1/2 inch (CBC 11B-303.3) and shall have a minimum width of 48 inches; CBC 11B-403.5.1.
 - 4. Surface cross slopes shall not exceed 2 percent on any accessible path of travel.
- C. Albedo Reflectance of Finish Concrete: 0.30, minimum.

2.03 FORM MATERIALS

- A. Wood form material, profiled to suit conditions.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
 - 1. Thickness: 1/2 inch.

2.04 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) yield strength; deformed billet steel bars; unfinished.
- B. Dowels: ASTM A615/A615M, Grade 60 - 60,000 psi yield strength; deformed billet steel bars; unfinished finish.

2.05 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C150/C150M, Sulfate Resistant - Type V Portland cement, gray color.
- C. Fine and Coarse Mix Aggregates: ASTM C33/C33M.
- D. Water: Clean, and not detrimental to concrete.
- E. Chemical Admixtures: ASTM C494/C494M, Type A - Water Reducing, Type C - Accelerating, and Type G - Water Reducing, High Range and Retarding.
 - 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.06 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1-D, Class A.
 - 1. Comply with all applicable air pollution requirements.
- B. Liquid Surface Sealer:
 - 1. High solids, acrylic curing and sealing compound: Minimum 30% non-yellowing, acrylic solids curing compound; shall conform to ASTM C309 and ASTM C1315, Type I, Class A, VOC compliant.
 - a. Acceptable Products:
 - 1) L&M Construction Chemicals, Inc.; Dress & Seal WB: www.lmcc.com.
 - 2) L.M. Scofield Company; Cureseal-W: www.scofield.com.
 - 3) W. R. Meadows Company; Decra-Seal W/B: www.wrmeadows.com.
 - 4) Substitutions: See Section 01 60 00 - Product Requirements.
- C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
 - 1. Material: Closed-cell, non-absorbent, compressible polymer foam in sheet form.

2.07 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- D. Concrete Properties:
 - 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; As indicated on drawings.
 - 2. Water-Cement Ratio: Maximum 50-60 percent by weight, or according to indicated concrete strength..

2.08 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.04 PREPARATION

- A. Project Conditions:
 - 1. Water and Dust Control: Maintain control of concrete dust and water at all times. Do not allow adjacent planting areas to be contaminated.
- B. Moisten base to minimize absorption of water from fresh concrete.
- C. Notify Architect minimum 24 hours prior to commencement of concreting operations.

3.05 COORDINATION WITH EXISTING CONSTRUCTION

- A. Connection to Existing Construction: Where new concrete is doweled to existing construction, drill holes in existing concrete, insert steel dowels and pack with non-shrinking grout.
- B. Preparation of Existing Concrete: Prepare previously placed concrete by cleaning with steel brush and apply bonding agent in accordance with manufacturer's instructions.

3.06 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.07 REINFORCEMENT

- A. Place reinforcement at midheight of slabs-on-grade.

1. Locate reinforcement to provide required cover by concrete. If not otherwise indicated on Drawings, provide concrete cover in compliance with ACI 318.
 2. Reinforcement Spacing: Space reinforcement as indicated on Drawings or in Standard Specifications, whichever is more stringent. If not indicated, maintain clear spacing of two times bar diameter but not less than 1-1/2 inch nor less than 1-1/3 times maximum size aggregate.
 3. Reinforcement Supports: Provide load bearing pads under supports or provide precast concrete block bar supports.
- B. Interrupt reinforcement at contraction and expansion joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.
1. Secure tie dowels in place before depositing concrete.
 2. Provide No. 3 bars, 18 inch long at 24 inches O.C. for securing dowels where no other reinforcement is provided.

3.08 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.09 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
 1. Mixing: If batch plant is within travel time not exceeding maximum limits, transit mix concrete in accordance with ASTM C94/C94M. If travel time exceeds limits, provide alternative means for mixing and submit for review and approval.
- B. Do not place concrete when base surface is wet.
- C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- E. Place concrete to pattern indicated.

3.10 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 1/2 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
 2. Secure to resist movement by wet concrete.
 3. If expansion joints are not indicated, conform to SSPWC (Greenbook) and standard details and specifications of authorities having jurisdiction.

- C. Provide sawn joints.
 - 1. At 5 feet intervals for pedestrian paving.
 - 2. At 10 feet intervals for vehicle paving.
 - 3. Between sidewalks and curbs.
 - 4. Between curbs and pavement.
- D. Provide keyed joints as indicated.
- E. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.
- F. Refer to Architectural, Landscape and Civil Drawings for additional information and joint locations.

3.11 FINISHING

- A. Area Paving: Medium broom, texture perpendicular to pavement direction..
- B. Sidewalk Paving: Medium broom, texture perpendicular to pavement direction with troweled and radiused edge 1/4 inch radius.
 - 1. Broomed: Pull broom across freshly floated concrete to produce medium texture in straight lines perpendicular to main line of traffic. Do not dampen brooms.
- C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
- D. Specific Finishes: Where indicated on Drawings.
 - 1. Concrete Paving Finish: ACI 301, two-step trowel finish, followed after surface has achieved initial set by flooding of surface and light rubbing with bristle brush so that concrete fines are exposed slightly.
 - a. Finish surface less than 6 percent shall receive medium broom finish resembling medium grit sandpaper. CBC 11B-403 and 11B-302.1.
 - b. Finish surface greater than 6 percent shall receive heavy broom finish. CBC 11B-403 and 11B-302.1.
 - c. Surfaces shall have static coefficients of friction of 1.3 to 1.6 (dry) and 1.2 to 1.4 (wet) when field tested in accordance with ASTM D2047.
- E. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.12 TOLERANCES

- A. ACI 301, Class B, except paving in public rights-of-way shall conform to SSPWC (Greenbook).
- B. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- C. Maximum Variation From True Position: 1/4 inch.
- D. Control-joint grooves and other conspicuous lines:
 - 1. 1/4 inch maximum in any 20 feet.
 - 2. 1/2 inch maximum in any 40 feet.
- E. Variation in Cross-Sectional Thickness of Slabs:
 - 1. Minus 1/4 inch.

2. Plus 1/2 inch.
- F. Variation in Radii
1. In radii of less than 10 feet:
 - a. 1/8 inch in any 5 feet.
 - b. 1/4 inch in any 10 feet.
 2. In radii of 20 feet:
 - a. 1/4 inch in any 10 feet.
 - b. 3/8 inch in any 20 feet
 3. In radii of 30 feet or more:
 - a. 1/2 inch in any 20 feet.
 - b. 1 inch in any 30 feet.
- G. Coefficient of Friction for Finish Surface:
1. Pedestrian Vehicular Finish Surface: Minimum 0.6 static coefficient of friction is required for all concrete paving finish surface. All concrete paving surfaces to be broom finish.
 2. Ramps: Minimum 0.8 static coefficient of friction is required for all concrete paving finish surfaces on ramps. All concrete paving surfaces on ramps to be broom finish.

3.13 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 3. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 75 cu yd or less of each class of concrete placed.
1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 2. Perform one slump test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.14 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
1. Provide lumber ramping and plywood covering where curbs and gutters are subject to vehicular and equipment traffic during construction.

END OF SECTION

SECTION 32 33 13

ROLLING BIKE RACK

PART 1 GENERAL

1.01 Summary

- A. This section includes specifications for the Rolling Bike Rack.
- B. Bikes parked per unit:
 - 1. 2H: 5 bikes
 - 2. 3H: 7 bikes
 - 3. 4H: 9 bikes
 - 4. 5H: 11 bikes
 - 5. 6H: 13 bikes

1.02 Quality Assurance

- A. Installer Qualifications: An experienced installer who has completed installation of bicycle racks similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing bicycle racks similar to those required for this project and with a record of successful in-service performance.
- C. Source Limitations: Obtain each color, finish, shape and type of bicycle rack from a single source with resources to provide components of consistent quality in appearance and physical properties.
- D. Product Options: Drawings indicate size, shape and dimensional requirements of bicycle racks and are based on the specific system indicated.

1.03 Submittals

- A. Product Data: Include physical characteristics such as shape, dimensions, bicycle parking capacity and finish for each bicycle rack.
- B. Shop Drawings: Show installation details for each bicycle rack.
- C. Samples for Verification: Submit finish samples for review and verification.
- D. Maintenance Data: For each bicycle rack.
 - 1. Include recommended methods for repairing damage to the finish.

1.04 Delivery, Storage and Handling

- A. Upon delivery, before signing for shipment, inspect for any damages and notate on the B.O.L.
- B. Store bicycle racks in original undamaged packages and containers until ready for installation
- C. Handle bicycle racks with sufficient care to prevent any scratches or damage to the finish.

PART 2 PRODUCTS

2.01 Acceptable Manufacturers

- A. Provide bicycle racks manufactured by DERO BIKE RACK CO., 42 Northern Stacks Drive, Suite 100, Minneapolis, MN 55421, 1-888-337-6729. Fax: 612-331-2731 Website: www.dero.com

2.02 Materials

- A. 2.375" OD Schedule 40 Pipe per ASTM A53
- B. In ground Rolling Racks have a 3/8" x 3" steel rod welded to the bottom to ensure the rack doesn't pull out after the concrete cures.
- C. Surface mount Rolling Racks have two 5.5" x 5.25" x .25" feet.

2.03 Finishes

- A. A hot-dipped galvanized finish performed after fabrication is standard.
- B. Over 250 high quality TGIC powder-coated colors are available from Dero Bike Rack Co.
 - 1. For powder coated/ painted racks, the following specifications are required: Part is prepared for painting with hard sandblasting. An epoxy primer is electrostatically applied. A final TGIC, UV resistant polyester powder coat is applied. Final coating thickness shall be no less than 6 mils.
- C. A 304 grade stainless steel finish is also available. Either a satin #4 finish or high luster electropolish finish. Both finish options include the Spectra Shield finish for maximum corrosion protection.

2.04 Rolling Bike Rack

- A. Space Use
 - 1. Bikes will be locked perpendicular to the Rolling Rack as shown in the diagrams. When bikes are locked to it, the Rolling Rack will use approximately the amount of space listed in the installation diagrams.
 - 2. To ensure that the Rolling Rack is convenient and safe for bicyclists, use these minimum space use configurations when installing a Rolling Rack next to a wall or street, or if you are putting several Rolling Racks next to each other.

B. Setbacks

1. Wall Setback: A minimum of 27" should be left between the wall and the rack. 36" is the recommended setback.
2. Street Setback: For racks running parallel to the street, a 96" setback is recommended. For racks installed perpendicular to the street a 24" setback is the minimum setback distance between the street and the rack. 36" is recommended.
3. The foot-mounted Rolling Rack has a 5.5" x 5.25" x .25" plate which is installed onto a concrete base with 4 masonry anchors. The foot-mounted Rolling Rack is generally less expensive to install and easier to remove than the in-ground mount model, while maintaining the same degree of security. 3/8" anchors are the standard anchor shipped with this rack.

PART 3 EXECUTION

3.01 Installation

- A. Installation Method: In-ground mount is embedded into concrete base.
- B. Flange mount has two 5.5" x 5.25" x .25" feet plates - 8 anchors.
- C. It is the responsibility of the installer to ensure that all base materials into which the rack will be installed can support the rack and will not be damaged by any required installation procedures.

3.02 Ordering Information

- A. When ordering or specifying this rack, make sure the product type, finish and fastener type (if applicable) are included. Contact your Dero representative for a current price list or to place an order.

3.03 Included with every Bike Rack

- A. Included in the price is a hot-dipped galvanized finish. The foot-mounted Rolling Rack includes 8 wedge anchors or concrete spikes.

3.04 Freight

- A. Call 1-888-337-6729 for freight quotes.

END OF SECTION

SECTION 32 33 14
SITE BICYCLE LOCKER

PART 1 – GENERAL

1.01 SUMMARY

- A. This section includes the following:
 - 1. Bicycle Lockers

1.02 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed installation of similar bicycle parking racks.
- B. **Manufacturer Qualifications:** Graber Manufacturing, Inc. is a skilled manufacturer of bicycle parking racks since 1989.
- C. **Source Limitations:** For consistent quality in appearance and physical properties obtain each product from Graber Manufacturing, Inc.
- D. **Product Options:** Drawings indicate size, shape and dimensional requirements of furnishings for the purpose of customer sourcing.

1.03 SUBMITTALS

- A. **Product Data:** Include physical characteristics such as materials, specifications and finish.
- B. **Drawings:** Show details including dimensions, materials, and options for each product.
- C. **Samples for Verification:** Finish samples of the color and type of powder coat will be provided upon request.
- D. **Maintenance Data:** For each product include the recommended methods for repairing damage to the powder coat and materials finish will be provided.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store product(s) in original undamaged packaging and containers until ready for installation.
- B. Handle powder coated product(s) with sufficient care to prevent any scratches or damage to the finish.

1.05 WARRANTY

- A. Bicycle lockers carry a one year manufacturer's limited warranty against defects in materials and workmanship. The warranty period begins the date of invoice.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Madrax, a division of Graber Manufacturing, Inc. 1080 Uniek Drive, Waunakee, WI 53597. Toll free phone: 800-448-7931. Local phone: 608-849-1080.

2.02 MATERIALS

- A. **Powder Coating:** Triglycidyl isocyanurate (TGIC) powder, a polyester coating. Coating is applied so that the thickness is 3.5 to 4.5 mils.
 - 1. Color as selected by architect from manufacturer's full range of standard colors.
- B. **Galvanizing:** Standard specification for zinc (hot-dip galvanized) coatings on iron and steel products:
 - 1. Finish is bright in appearance for 6 to 12 months after processing. The finish dulls to a matt grey after during this period of time.
 - 2. The product will have vent holes to allow gases to escape a molten galvanize to enter internal spaces.
 - 3. Surface quality will meet the American Galvanizing Association standards.

2.03 BICYCLE LOCKERS

- A. **MADLocker™:** The bicycle locker shall be the ML__-__-__-P (insert locker style, number of bikes, and optional floor). Manufactured by Madrax, a division of Graber Manufacturing, Inc.
 - 1. Galvanized and powder coated version components:
 - a. Exterior walls, tops, floors, doors, partitions and stiffeners shall be constructed of 16 ga. G90 bonderized steel.
 - b. Door frames shall be constructed of 12 ga. carbon cold rolled steel. Hot dip galvanized after fabrication.
 - c. Door hinge shall be constructed of 15 ga. stainless steel.
 - d. Locking bar shall be constructed of 3/4" wide x 3/16" thick (19.05mm x 4.76mm) stainless steel.

2. Handle/Lock options:
 - a. Heavy duty pop-out "T" handle with two user keys (keyed differently).
 - b. Stainless steel padlock style handle (padlock not included).
 - c. Stainless steel U-lock and padlock style handle (padlock and U-lock not included).

2.04 REFERENCES

A. Steel Sheet:

1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

B. Door Frame:

1. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

C. Door Hinge:

1. ASTM A304 Standard Specification for Carbon and Alloy Steel bars Subject to End-Quench Hardenability Requirements

D. Locking Bar Mechanism:

1. ASTM A304 Standard Specification for Carbon and Alloy Steel bars Subject to End-Quench Hardenability Requirements

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Embedded mounting: Material is to be extended a minimum of 10" (254mm) below finish surface and cast in concrete.
- C. Surface mounting: Location and drilling of holes for inserts included.
- D. Some assembly required.

END OF SECTION

Geotechnical Report

DSPS Modular Building **Imperial Valley College** **Imperial, California**

Prepared for:

Imperial Community College District
380 East Aten Road
Imperial, CA 92251



Prepared by:



Landmark Consultants, Inc.
780 N. 4th Street
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May 2020



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May 26, 2020

Mr. Joe Jackson
Imperial Community College District
380 East Aten Road
Imperial, CA 92251

**Geotechnical Report
DSP Modular Building
Imperial Valley College
380 East Aten Road
Imperial, California
*LCI Report No. LE20064***

Dear Mr. Jackson:

Attached hereto is our geotechnical report for the proposed construction of a new 4,320-square-foot modular building located on the northeast portion of the Imperial Valley College campus located at 380 East Aten Road in Imperial, California. Our geotechnical investigation was conducted in response to your request for our services. The enclosed report describes our soil engineering investigation and presents our professional opinions regarding geotechnical aspects for design and construction of the project.

This executive summary presents *selected* elements of our findings and professional opinions only. It *does not* present all details needed for the proper application of our findings and professional opinions. Our findings, professional opinions, and application options are related *only through reading the full report*, and are best evaluated with the active participation of the engineer of record who developed them.

The findings of this study are summarized below:

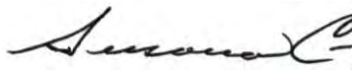
- The soils at the modular building site consists of silty clay (CL) of medium expansion potential.
- The proposed footings may be supported on the undisturbed stiff natural soils encountered
- The clay soils are aggressive to concrete and steel. Concrete mixes should have a maximum water cement ratio of 0.45 and a minimum compressive strength of 4,500 psi (minimum of 6 sacks Type V cement per cubic yard).
- All reinforcing bars, anchor bolts and hold down bolts should have a minimum concrete cover of 3.0 inches unless epoxy coated (ASTM D3963/A934). Hold-down straps are not allowed at the foundation perimeter.

- Evaluation of liquefaction potential at the site indicates that a sandy silt to silty sand layer at a depth of 12 to 18 feet may liquefy under seismically induced groundshaking, potentially resulting in approximately ½ inch of deep-seated settlement. About 12 feet of non-liquefiable soils overlie the potentially liquefiable soil layer; therefore, there is a low probability of rapid deformation or punching bearing failures of the surface soils should liquefaction occur. Deep foundations or deep soil improvement is not required at this project site.

The site is suitable for the proposed modular classroom project, provided the professional opinions expressed in this report are implemented in the design and construction of this project.

We appreciate the opportunity to provide our professional services. If you have any questions or comments regarding our findings, please call our office at (760) 370-3000.

Respectfully Submitted,
Landmark Consultants, Inc.



Susana Kemmerrer, GE
Geotechnical Engineer



Steven K. Williams, PG, CEG
Senior Engineering Geologist



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- Table 1: Summary of Characteristics of Closest Known Active Faults
- Table 2: 2016 California Building Code (CBC) and ASCE 7-10 Seismic Parameters
- Table 3: Data for Site Specific Response Spectrum
- Table 4: Site-Specific Design Response Spectrum

Figures:

- Figure 1: Regional Fault Map
- Figure 2: Map of Local Faults
- Figure 3: Deterministic Maximum Considered Earthquake
- Figure 4: Site-Specific Maximum Considered Earthquake
- Figure 5: Site-Specific Design Response Spectrum

Appendices:

- Appendix A: Vicinity and Site Maps
- Appendix B: Boring Logs and Key to Log Symbols
- Appendix C: Laboratory Test Results
- Appendix D: Liquefaction Analysis
- Appendix E: Pipe Bedding and Trench Backfill Recommendations

Section 1

INTRODUCTION

1.1 Project Description

The proposed project will consist of the construction of a 4,320 square foot modular building located on the northeast portion of the Imperial Valley College campus located at 380 East Aten Road in Imperial, California.

The modular building is planned to be placed at-grade with an 8-inch wide perimeter concrete stem-wall set on a perimeter “T” footing. The bottom of footings are expected to be founded 2 to 3 feet below the existing ground surface. Welded steel beams supported on short concrete columns and spread footings will be used to support the modular building steel framed flooring system. The modular building will have steel framed walls and roof system. Foundations are expected to be moderately loaded.

For the purposes of our analysis and report, we have assumed that structural loads will not exceed 5 kips per linear foot for wall footings and 30 kips for the column footings. *If structural loads exceed those used in our analysis, we should be notified so we may evaluate their impact on settlement estimates for the foundations.*

Site development will include subexcavation for the modular unit foundations (about 2½ feet), underground utility installation including trench backfill, concrete stem-wall and flooring system support construction and sidewalk and hardscape construction.

1.2 Purpose and Scope of Work

The purpose of our geotechnical investigation was to evaluate the physical characteristics of the on-site soils and to provide geotechnical criteria for site grading, design of foundations and slabs.

Our scope of work included the following:

- Review of background information including available published geologic maps and literature.
- Field exploration consisting of performing two (2) Cone Penetrometer Test (CPT) soundings to depths of 25 to 50 feet below the existing ground surface.
- Laboratory testing of selected soil samples including: grain size analysis, plasticity index tests, and chemical analyses consisting of soluble sulfate and chloride contents, pH, and resistivity.
- Engineering analysis and evaluation of the data collected.
- Preparation of this report presenting our findings, professional opinions, and design criteria for the geotechnical aspects of the project development.

Our scope of work specifically excluded an evaluation of the site for the presence of hazardous materials or conditions.

1.3 Authorization

Dr. Martha Garcia, Imperial Community College District Superintendent, provided written authorization to proceed with our work on April 8, 2020. We conducted our work according to our written proposal dated March 24, 2020.

Section 2

METHODS OF INVESTIGATION

2.1 Field Exploration

The subsurface exploration was performed on April 27, 2020 using Middle Earth Geo-Testing, Inc. of Orange, California to advance two (2) electric CPT soundings to approximate depths of 25 to 50 feet below existing ground surface. The soundings were completed at the approximate locations shown on the Site and Exploration Plan (Plate A-2). Shallow (3-foot deep) hand auger borings (3-inch diameter) were made adjacent to the CPT soundings in order to obtain near surface soil samples for laboratory testing. The approximate sounding locations were established in the field and plotted on the site map by sighting to discernible site features.

CPT soundings provide a continuous profile of the soil stratigraphy with readings every 2.5 cm (1 inch) in depth. The CPTs were conducted by hydraulically advancing an instrumented Hogentogler 10 cm² conical probe into the ground at a rate of 2 centimeters per second (cm/s) using a 23-ton truck as a reaction mass. An electronic data acquisition system recorded a nearly continuous log of the resistance of the soil against the cone tip (Q_c) and soil friction against the cone sleeve (F_s) as the probe was advanced. Empirical relationships (Robertson and Campanella, 1989) were then applied to the data to obtain a continuous profile of the soil stratigraphy. Interpretation of CPT data provides correlations for Standard Penetration Test (SPT) blow count, phi (ϕ) angle (soil friction angle), undrained shear strength (S_u) of clays and over-consolidation ratio (OCR). These correlations may then be used to evaluate vertical and lateral soil bearing capacities and consolidation characteristics of the subsurface soil.

Interpretive logs of the CPT soundings are presented on Plates B-1 and B-2 in Appendix B. A key to the interpretation of CPT soundings is presented on Plate B-3. The stratification lines shown on the subsurface logs represent the approximate boundaries between the various strata. However, the transition from one stratum to another may be gradual over some range of depth.

2.2 Laboratory Testing

Laboratory tests were conducted on selected bulk soil samples obtained from the hollow-stem auger borings to aid in classification and evaluation of selected engineering properties of the near surface soils. The tests were conducted in general conformance to the procedures of the American Society for Testing and Materials (ASTM) or other standardized methods as referenced below. The laboratory testing program consisted of the following tests:

- ▶ Plasticity Index (ASTM D4318) – used for soil classification and expansive soil design criteria
- ▶ Grain Size Analysis (ASTM D422) – used for soil classification
- ▶ Chemical Analyses (soluble sulfates & chlorides, pH, and resistivity) (Caltrans Methods) – used for concrete mix design parameters and corrosion protection requirements.

The laboratory test results are presented on Plates C-1 through C-3 in Appendix C of this report.

Section 3

DISCUSSION

3.1 Site Conditions

The Imperial Valley College campus is located at 380 East Aten Road in Imperial, California. The campus location is depicted on Plate A-1, Vicinity Map. The coordinates of the project site are 32.8297N / -115.5031W. The proposed modular building will be located in the northeastern portion of the college campus as shown on Plate A-2. The proposed building footprint is located in the grass area south of the science building (Building 2700). Concrete sidewalks are located on the north and west sides of the building site. The topography in the site vicinity is planar as depicted on Plate A-4, Topographic Map.

3.2 Geologic Setting

The project site is located in the Salton Trough physiographic province of southern California. The Salton Trough is a geologic structural depression resulting from large scale regional faulting. The trough is bounded on the northeast by the San Andreas Fault and on the southwest by faults of the San Jacinto Fault Zone. The Salton Trough represents the northward extension of the Gulf of California, which has experienced continual in-filling with both marine and non-marine sediments since the Miocene Epoch. The tectonic activity that formed the trough continues to the present at a high rate as evidenced by deformed young sedimentary deposits and high levels of historic seismicity.

The site is directly underlain by Holocene (1 to 11,000 years before present) Cahuilla Lake bed deposits, which consist of interbedded lenticular and tabular silts, sands, and clays. The Holocene Lake deposits are probably less than 100 feet thick beneath the site. The Pleistocene Brawley Formation underlies the Cahuilla Lake bed deposits. The Brawley Formation consists of at least 2,000 feet of gray clays, sands, and pebbles, which in turn overlie about 6,000 feet of the late Pliocene Borrego Formation. The Borrego Formation consists of lacustrine clays and sands. The Borrego Formation overlies an undetermined thickness of the Pliocene marine Imperial Formation, Alverson Andesite, and Miocene continental sediments of the Split Mountain Formation.

Basement rock consisting of Mesozoic granite and possibly Paleozoic metamorphic rocks are estimated to exist at depths between 15,000 and 20,000 feet below the surface. The surface geology of the site is depicted on Plate A-5.

3.3 Site Subsurface Conditions

The results of our subsurface investigation at the site, along with the review of available geologic maps and literature, indicate that the site is underlain by Cahuilla Lake bed deposits to the maximum depth explored of 50 feet. Stiff silty clays (CL) were encountered from the ground surface to a depth of about 4 feet. A 5-foot thick medium dense to dense silty sand (SM) layer extends from 4 to 9 feet. Stiff silty clay was encountered between depths of 9 to 12 feet. A medium dense zone of silty sand to sandy silt was encountered from depths of about 12 to 18 feet. Stiff silty clays (CL) extend from 18 to 50 feet below ground surface. A schematic geologic cross section is presented on Plate A-6.

Groundwater was not measured in the CPT soundings during the exploration. Groundwater was reported at a depth of about 8.9 feet during a previous geotechnical investigation performed at Imperial Valley College by Landmark. There is uncertainty in the accuracy of short-term water level measurements, particularly in fine-grained soil. Groundwater levels may fluctuate with precipitation, irrigation of adjacent properties, drainage, and site grading. The referenced groundwater level should not be interpreted to represent an accurate or permanent condition.

Historic groundwater levels are approximately 8 feet below ground surface at the project site. USGS Professional Paper 486-K, Plate 1 shows the project site being located between the -60 and -80 foot groundwater elevation contours. Historical groundwater is estimated to be at an elevation of -73 feet at the project site. The site elevation is approximately 65 feet below sea level which would equate to a historical groundwater depth of about 8 feet.

3.4 Seismic Hazards

3.4.1 Faulting and Seismicity

The project site is located in the seismically active southern California region and is expected to be subjected to moderate to strong ground shaking during the design life of the project.

A fault map illustrating known active faults relative to the site is presented on Figure 1, *Regional Fault Map*. Figure 2 shows the project site in relation to local faults.

The criterion for fault classification adopted by the California Geological Survey defines Earthquake Fault Zones along Holocene-active or pre-Holocene faults (CGS, 2018b). Earthquake Fault Zones are regulatory zones that address the hazard of surface fault rupture. A Holocene-active fault is one that has ruptured during Holocene time (within the last 11,700 years). A pre-Holocene fault is a fault that has not ruptured in the last 11,700 years. Pre-Holocene faults may still be capable of surface rupture in the future, but are not regulated by the A-P act. Table 1 lists known faults or seismic zones that lie within a 33 mile (53 kilometer) radius of the project site.

The site is not located within a currently designated Earthquake Fault-Rupture Hazard Zone (CGS, 2020b). Review of the current Alquist-Priolo Earthquake Fault Zone maps (CGS, 2020a) indicates that the nearest mapped Earthquake Fault Zone is the Imperial fault, located approximately 0.2 miles northeast of the site. The possibility of ground surface rupture related to active faulting on currently unrecognized faults exists throughout the seismically active Imperial Valley region. However, given the current state of knowledge regarding seismicity of the Imperial Valley, the potential for fault rupture at the project site is considered low.

3.4.2 Historic Seismicity

The Imperial Valley is one of the most seismically active regions in the United States, and has experienced several historical events of magnitude 5.5 or more. The following briefly outlines seismic events that have significantly affected the Imperial Valley in the past 100 years.

Imperial Valley Events: June 22, 1915. Two earthquakes with magnitudes of 6.0 and 5.9 occurred about an hour apart near El Centro.

El Centro Event: May 19, 1940: A magnitude 7+ earthquake ruptured the Imperial Fault with horizontal offsets up to 19 feet at the international border with Mexico. This earthquake triggered widespread liquefaction as evidenced by sand boils throughout the Imperial Valley.

Imperial Valley Event: October 15, 1979. A magnitude 6.6 earthquake ruptured the Imperial Fault with horizontal offsets up to 2 feet and damage to buildings in El Centro, Imperial, and Calexico. This event triggered widespread liquefaction as evidenced by sand boils throughout the Valley.

A magnitude 5.8 aftershock occurred along the Brawley Fault on that same evening causing severe damage to several unreinforced masonry buildings in Brawley.

Westmorland Event: April 26, 1981. A magnitude 6.0 earthquake occurred 4 miles north of Westmorland triggering liquefaction in the epicentral region. Although there was no evidence of surface rupture associated with this event, canals and buildings were damaged. Liquefaction reportedly occurred in the Brawley Seismic Zone during magnitude 5+ events in 1930, 1950 and 1957.

Superstition Hills Events: November 24, 1987. A magnitude 6.6 earthquake ruptured the Superstition Hills fault, causing 15 miles of surface rupture displaying a right lateral offset (maximum 26 inch offset). The earthquake triggered liquefaction in areas from the Salton Sea to Seeley. A magnitude 6.2 event occurred as a foreshock along the Elmore Ranch fault. The Elmore Ranch fault had not been recognized until this event.

El Mayor-Cucapah Event: April 4, 2010. A magnitude 7.2M_w earthquake ruptured the Laguna Salada, Borrego and Pescadores faults south of Mexicali, Mexico. The Borrego and Pescadores faults exhibited approximately 60 miles of surface rupture with a dip-slip displacement of up to 250 cm (8 feet). Widespread liquefaction and lateral spreading occurred in the Mexicali and Imperial Valleys during this event.

Brawley Swarm Event: August 26-28, 2012. An earthquake swarm with eleven (11) earthquakes above magnitude 4.0 (the largest being 5.5M_w) occurred approximately 2 miles northwest of Brawley, California. Although there was no evidence of surface rupture associated with this event, numerous structures in Brawley were damaged.

3.5 Site Specific Ground Motion Analysis

The California Building Code (CBC) requires that a site-specific ground motion hazard analysis be performed in accordance with ASCE 7-16 Section 11.4.8 for structures on Site Class D and E sites with S_1 greater than or equal to 0.2 and Site Class E sites with S_s greater than or equal to 1.0. This project site has been classified as Site Class D by previous geotechnical reports for the Imperial Valley College campus.

Landmark conducted a site-specific ground motion analysis in accordance with ASCE 7-16 Section 21.2 and 2019 CBC Section 1803A.6. Our analysis was performed using the computer program EZ-Frisk, version 8.06 (Risk Engineering, 2020).

The analysis utilized the maximum rotated component (MCR) to determine the ground motions using the Next Generation Attenuation (NGA) relationships of Abrahamson-Silva (2008), Boore-Atkinson (2008), Campbell-Bozorgnia (2008), and Chiou-Youngs (2008).

The probabilistic (MCE_R) ground motion at the project site was determined in accordance with ASCE 7-16 Section 21.2.1.1 Method 1. The probabilistic ground motion response spectrum was determined as the product of the risk coefficient (C_R) and the spectral response acceleration from a 5% damped acceleration response spectrum having a 2% probability of exceedance within a 50-year period. The value of the risk coefficient was determined from the values of C_{RS} (0.949) and C_{R1} (0.923) obtained from ASCE 7-16 Figures 22-18A and 22-19A using the online Structural Engineers Association of California (SEAOC) and Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps Web Application (SEAOC, 2020). The probabilistic response spectrum is shown on Figure 4 and Table 3.

The deterministic seismic hazard analysis at the site was completed in accordance with ASCE 7-16 Section 21.2.2 using the computer program EZ-Frisk 8.06 to obtain the deterministic seismic response (MCE_R) for the project site. The deterministic analysis indicates that the fault controlling the ground motion at the project site is the Imperial fault ($MCE = 6.9$) located approximately 0.4 km northeast of the project site. The deterministic MCE_R acceleration response spectrum is defined as the largest 84th-percentile 5% damped spectral response spectral response acceleration in the direction of maximum horizontal response computed at that period. The deterministic ground motion response spectrum shall not be taken at lower than the corresponding ordinates of the response spectrum determined in accordance with ASCE 7-16 Figure 21.2-1 (Deterministic Lower Limit) and the 84th percentile values. The ordinates for the Deterministic Lower Limit were calculated for Site Class D taking F_a as 1.0 and F_v as 2.5. The deterministic response spectrum was calculated as the maximum of the Deterministic Lower Limit and the 84th percentile values. The deterministic response spectrum is shown on Figure 3 and Table 3.

The site-specific MCE_R spectral response spectrum was taken as the lesser of the spectral response accelerations from the probabilistic ground motions and the deterministic ground motions. The site-specific response spectrum is provided in Figure 4 and Table 3.

The design spectral response acceleration is defined in ASCE 7-16 Section 21.3 as $\frac{2}{3}$ of the site specific MCE_R , but not less than 80% of the general design response spectrum determined in accordance with ASCE 7-16 Section 11.4.6 taking F_a as 1.0 and F_v as 2.5. The site-specific design response spectrum is provided in Figure 5 and Table 4.

Since the site-specific ground motion procedures were used to determine the design ground motion in accordance with ASCE Section 21.3, site-specific design acceleration parameters (S_{DS} , S_{D1} , S_{MS} , and S_{M1}) were determined in accordance with ASCE 7-16 Section 21.4. The parameter S_{DS} shall be taken as 90% of the maximum spectral acceleration S_a obtained from the site-specific spectrum, at any period within the range from 0.2 to 5.0 seconds, inclusive. S_{DS} is determined to be 1.58g. The parameter S_{D1} shall be taken as the maximum value of the product, TS_a , for periods from 1 to 5 seconds for sites with $v_{s,30} \leq 1,200$ ft/s. S_{D1} is determined to be 1.57g. The parameters S_{MS} and S_{M1} shall be taken as 1.5 times S_{DS} and S_{D1} , therefore, $S_{MS} = 2.37$ and $S_{M1} = 2.36$. The values so obtained shall not be less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.3 for S_{MS} and S_{M1} and Section 11.4.5 for S_{DS} and S_{D1} . S_{MS} is determined to be 2.37g ($1.5 \times 1.32g = 2.37$, 80% of CBC general S_{MS} ($2.25g$) = 1.80g). S_{M1} is determined to be 2.36g ($1.5 \times 1.57g = 2.36g$, 80% of CBC general S_{MS} ($1.36g$) = 1.09g). Site-specific design acceleration parameters are provided in the following table.

Site-Specific Design Acceleration Parameters

Parameter	Value
S_{DS}	1.58
S_{D1}	1.57
S_{MS}	2.37
S_{M1}	2.36

The Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration (PGA) was determined in accordance with ASCE 7-16 Section 21.5. The site specific MCE_G PGA is calculated as the lesser of the probabilistic and deterministic geometric mean PGA. The site specific MCE_G PGA shall not be taken as less than 80% of the PGA_M determined from ASCE 7-16 Equation 11.8-1.

The probabilistic MCE_G peak ground acceleration shall be taken as the geometric mean peak ground acceleration with a 2% probability of exceedance within a 50-year period. The probabilistic MCE_G PGA is 1.42g.

The deterministic geometric mean PGA is the largest 84th-percentile geometric mean PGA for characteristic earthquakes on all known active faults within the site region. The deterministic geometric mean PGA shall not be taken as lower than $0.5F_{PGA}$, where F_{PGA} is determined using ASCE 7-16 Table 11.8-1. The 84th-percentile geometric mean PGA is 0.84g and $0.5F_{PGA} = 0.6g$ ($0.6 \times 1.00 = 0.6g$); therefore, the deterministic geometric mean PGA is 0.84g.

The site-specific MCE_G peak ground acceleration (PG_{AM}) shall be taken as the lesser of the probabilistic geometric mean peak ground acceleration and the deterministic geometric mean peak ground acceleration, but not less than 80% of the PG_{AM} determined from ASCE 7-16 Equation 11.8-1. The PG_{AM} determined from ASCE 7-16 Equation 11.8-1 is 1.03g and 80% of the PG_{AM} is 0.82g ($1.03g \times 80\% = 0.82g$). ***Therefore, the site-specific peak ground acceleration (PGA) for this project site is 0.84g.***

3.6 Liquefaction

Liquefaction occurs when granular soils below the water table are subjected to vibratory motions, such as produced by earthquakes. With strong ground shaking, an increase in pore water pressure develops as the soil tends to reduce in volume. If the increase in pore water pressure is sufficient to reduce the vertical effective stress (suspending the soil particles in water), the soil strength decreases and the soil behaves as a liquid (similar to quicksand). Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow bearing foundations. Four conditions are generally required for liquefaction to occur:

- (1) the soil must be saturated (relatively shallow groundwater);
- (2) the soil must be loosely packed (low to medium relative density);
- (3) the soil must be relatively cohesionless (not clayey); and
- (4) groundshaking of sufficient intensity must occur to function as a trigger mechanism.

All of these conditions exist to some degree at this site.

Methods of Analysis: The liquefaction potential at the project site was evaluated using the 1998 NCEER Liquefaction Workshop method. The 1998 NCEER method utilizes CPT readings from the site explorations and earthquake magnitude/PGA estimates from the seismic hazard analysis. The resistance to liquefaction is plotted on a chart of cyclic shear stress ratio (CSR) versus a corrected $Q_{t,cs}$. The analysis was performed using a site-specific PGA_M value of 0.84g, a groundwater depth of 8 feet and a threshold factor of safety (FS) of 1.3.

The computer program CLiq (Version 2.2.0.32, Geologismiki, 2017) was utilized for liquefaction assessment of the project site. The estimated settlements have been adjusted for transition zones between layers and the post liquefaction volumetric strain has been weighed with depth (Robertson, 2014 and Cetin et al., 2009). Computer printouts of the liquefaction analyses are provided in Appendix D.

The fine content of the liquefiable sands and silts increases their liquefaction resistance in that more ground motion cycles are required to fully develop the increased pore pressures. The CPT tip pressures (Q_c) were adjusted to an equivalent clean sand pressure ($Q_{t,cs}$) in accordance with 1998 NCEER method.

The soil encountered at the points of exploration included saturated silts sands that could liquefy during a Risk-Targeted Maximum Considered Earthquake (MCE_R). Liquefaction can occur within the medium dense silty sand to sandy silt layer encountered between depths of 12 to 18 feet. The likely triggering mechanism for liquefaction appears to be strong groundshaking associated with the rupture of the Imperial, Brawley, and Superstition Hills faults.

Liquefaction Induced Settlements: ***Based on empirical relationships, total induced settlements are estimated to be about ½ inch should liquefaction occur.*** The magnitude of liquefaction induced *differential* settlement is estimated at be two-thirds of the *total* potential settlement in accordance with California Special Publication 117; therefore, ***there is a potential for ¼ inch of liquefaction induced differential settlement at the project site.*** The differential settlement based on seismic settlements is estimated at ¼ inch over a distance of 30 feet.

Generally stiff to hard clays and dense silty sand and sandy silts about 12 feet in thickness overlie the liquefiable layer.

The non-liquefiable materials may act as a bridge over the liquefiable layer resulting in a fairly uniform ground surface settlement; therefore, wide area subsidence of the overburden soils would be the expected effect of liquefaction rather than bearing capacity failure.

Liquefaction Induced Ground Failure: Based on research from Ishihara (1985) and Youd and Garris (1995) small ground fissure or sand boil formation are unlikely because of the thickness of the overlying nonliquefiable soil. Sand boils are conical piles of sand derived from the upward flow of groundwater caused by excess porewater pressures created during strong ground shaking. Sand boils are not inherently damaging by themselves, but are an indication that liquefaction occurred at depth (Jones, 2003). Liquefaction induced lateral spreading is not expected to occur at this site due to the planar topography. According to Youd (2005), if the liquefiable layer lies at a depth greater than about twice the height of a free face, lateral spread is not likely to develop. No slopes or free faces occur at this site.

Liquefaction effects have not been reported after large earthquakes proximal to the Imperial Valley College project site. Review of McCrink, et al (2011) and Youd and Wieczorek (1982) indicate that the effects of liquefaction (sand boils, lateral spread, slumps) were observed after the 1979 Imperial Valley Earthquake and the 2010 El Mayor-Cucapah Earthquake approximately 3¾ miles east of the college campus along the Alamo River.

Mitigation: Based on an estimate of about ½ inch of total liquefaction induced settlements (¼ inch differential settlement), mitigation for liquefaction induced settlement is not required for this project site.

3.7 Other Geologic Hazards

Landsliding. No indications of landsliding were observed within the immediate vicinity of the project site from the geologic maps and during our site investigation. Based on the relatively planar topography of the site, the potential for landsliding is considered remote.

Volcanic hazards. The site is not located proximal to any known volcanically active area and the risk of volcanic hazards is considered very low. Obsidian Butte and Red Hill, located at the south end of the Salton Sea approximately 24 miles north of the project site, are small remnants of volcanic domes formed about 2,000 to 7,500 years ago.

The subsurface brine fluids around the domes have a high heat flow and are currently being utilized to produce geothermal energy.

Tsunamis, sieches, and flooding. The site does not lie near any large bodies of water, so the threat of tsunami, sieches, or other seismically-induced flooding is unlikely. The project site is located in FEMA Flood Zone X (Plate A-9), an area determined to be outside the 0.2% annual chance floodplain (FIRM Panel 06025C1725C).

Expansive soil. The soils at the project site consist of silty clays and clays that are moderately expansive (Expansion Index (EI) = 51 to 90). The clay is expansive when wetted and can shrink with moisture loss (drying). Development of building foundations and concrete flatwork will require provisions for mitigating potential soil expansion forces.

Hazardous Materials. The site is not located in proximity to any known hazardous materials (methane gas, tar seeps, hydrogen sulfide gas), and the risk of hazardous materials is considered very low.

Radon 222 Gas. Radon gas is not believed to be a potential hazard at the site.

Naturally occurring asbestos. The site is not located in proximity to any known naturally occurring asbestos, and the risk of naturally occurring asbestos is considered very low.

Hydrocollapse. The site is dominantly underlain by stiff silty clays and clays that are not susceptible to collapse with the addition of water to the site. The risk of hydrocollapse is considered very low.

Regional Subsidence. The project site is not located within a known area of regional subsidence.

Section 4

CONCLUSIONS

Based on the results of our field investigation and laboratory tests, it is our opinion that the proposed development of the modular building is feasible from a geotechnical standpoint, provided that the conclusions and professional opinions contained in this report are incorporated in the project plans and specifications and implemented during construction of the project. The following summarizes some of the pertinent geotechnical issues identified in our study:

- No known active or potentially active faults cross the site. The closest active fault to the site is the Imperial fault, located approximately 0.2 miles to the northeast.
- The site is considered likely to be subjected to moderate to high ground accelerations due to regional fault activity. A site-specific ground motion value of 0.84g was estimated for liquefaction and seismic settlement analysis in accordance with CGS Note 48.
- The on-site soils consist of moderate plasticity silty clay (CL) which are moderately expansive. If these soils are allowed to exist in close proximity to exterior flatwork, specialized design and construction procedures will be necessary to resist expansive forces. Building wall foundation and floor support will require provisions to avoid results of soil heave due to wetting of expansive soils.
- Footings may be supported in the undisturbed natural stiff clays at a depth of 3½ below the existing grade.
- A medium dense silty sand to sandy silt layer was encountered at a depth of 12 to 18 feet. This layer may liquefy under seismically induced groundshaking, potentially resulting in about ½ inch of deep seated settlement. A 12-foot non-liquefiable layer present above the liquefiable layer is likely to prevent liquefaction induced soil deformation at ground surface. The potential for generalized liquefaction risk is low.
- The potential for other geologic hazards including landsliding, tsunamis/seiches, volcanic hazards, hazardous materials, radon gas, naturally occurring asbestos, hydrocollapse, and regional subsidence are considered low.
- Groundwater is expected to be encountered at a depth of about 8 feet below ground surface.
- The on-site native soils are considered to have a high potential for corrosivity with respect to buried steel and sulfate attack to concrete materials.

Section 5

DESIGN CRITERIA

5.1 Site Preparation

5.1.1 Clearing and Grubbing

At the time of construction, all existing pavement, debris and vegetation such as grass or trees on the site should be removed. Organic strippings should be hauled from the site and should not be incorporated into any engineered fills. Any trash, construction debris, concrete slabs, old pavement, landfill, and buried obstructions should be located by the grading contractor and removed under the observation of a qualified geotechnical firm. Excavations resulting from site clearing should be dish-shaped to the lowest depth of disturbance and backfilled with engineered fill as described below under continuous observations by the geotechnical engineer's representative.

Native soil, free of concentrations of vegetation or other deleterious materials, may be used as engineered fill placed in loose lifts not exceeding 8 inches, moisture conditioned to 5 to 10% above optimum and compacted to 85 to 90% of ASTM D1557 maximum density.

5.1.2 Modular Building Foundation

The native soils within the modular building area should be removed to sub-excavation level. The sub-excavation level is approximately 2 to 2½ feet below the existing grade. Footings shall be excavated into undisturbed soil at the bottom of the modular unit excavation. The footings subgrade should be neat cut and all irregular surfaces should be cut smooth to expose firm (stiff) soil. No soil compaction is required below the footings unless soil disturbance occurs.

Removals will also assist in locating any buried debris and man-made fills which should be removed and replaced with native soil that has been moisture conditioned to 5 to 10% above optimum moisture content and compacted to 85 to 90% of ASTM D1557 maximum dry density.

Before placement of concrete for footings, the bottom of the footing excavation should be moisture conditioned to 5 to 10% above optimum to a minimum depth of 12 inches. Surface grades should be designed to drain away from the structure.

5.1.3 Observation and Density Testing

All site preparation and fill placement should be continuously observed and tested by a representative of a qualified geotechnical engineering firm as required by the CBC. This includes the excavation and scarification process to detect any undesirable materials, conditions or soft areas that may be encountered in the construction area.

The geotechnical firm that provides observation and testing during construction shall assume the responsibility of "*geotechnical engineer of record*", and as such, shall perform additional testing/investigation as necessary to satisfy themselves as to the site conditions and the geotechnical recommendations for site development. The geotechnical engineer should provide a verified report of the as-graded site and building support pad conditions.

5.2 Foundations and Settlements

Continuous perimeter wall footings and shallow spread footings are suitable to support the modular building. The foundations may be designed using an allowable soil bearing pressure of 1,500 psf when foundations are supported on undisturbed stiff native clay soils at a depth of 3½ feet below existing grade.

All footings should be embedded a minimum of 12 inches below the modular building sub-excavation pad. Minimum embedment depth of interior footings should be at least 12 inches below the sub-excavation. Interior and exterior footing embedment depths listed herein are minimum depths and actual depths/widths shall be determined by the structural engineer/designer. Continuous wall footings should have a minimum width of 18 inches.

Spread footings should have a minimum dimension of 24 inches and should be structurally tied to perimeter footings or grade beams to reduce expansive clay soil movement. Concrete reinforcement and sizing for all footings should be provided by the structural engineer.

Measures should be taken to prevent introduction of water into the sub-floor space which may cause expansion and heaving of the clay soils.

Resistance to horizontal loads will be developed by the passive earth pressure on the sides of footings and the frictional resistance developed along the base of footings and concrete slabs. The passive resistance may be calculated using an equivalent fluid pressure of 250 pounds per cubic foot (pcf). The top one foot of embedment should not be considered in computing passive resistance unless the adjacent area is confined by a slab or pavement. An allowable friction coefficient of 0.25 may also be used at the base of the footings to resist lateral loading.

Non-seismically induced foundation settlement is estimated to be on the order of $\frac{3}{4}$ -inch with differential movement of about two-thirds of total settlement for the loading assumptions stated above when the subgrade preparation guidelines given above are followed. Seismically induced (post-liquefaction) settlements are addressed in Section 3.6 of this report.

5.3 Slabs-On-Grade

Structural Concrete: Structural concrete slabs are those slabs (foundations) that underlie structures or patio covers (shades). These slabs that are placed over native clay soil should be designed in accordance with Chapter 18 of the 2019 CBC and shall be a minimum of 5 inches thick due to expansive soil conditions.

No special requirements exist for slabs placed on 2½ feet of granular fill compacted to a minimum of 95% of ASTM D1557 maximum density. Concrete floor slabs shall be monolithically placed with the footings (no cold joints) unless placed on 2½ feet of granular fill.

American Concrete Institute (ACI) guidelines (ACI 302.1R-7 Chapter 3, Section 3.2.3) provide recommendations regarding the use of moisture barriers beneath concrete slabs. The concrete floor slabs should be underlain by a 10-mil polyethylene vapor retarder that works as a capillary break to reduce moisture migration into the slab section. The vapor retarder should be properly lapped and continuously sealed and extend a minimum of 12 inches into the footing excavations.

The vapor retarder should be covered by 4 inches of clean sand (Sand Equivalent SE>30) unless placed on 2½ feet of granular fill, in which case, the vapor retarder may lie directly on the granular fill with 2 inches of clean sand cover.

Concrete slabs may be placed without a sand cover directly over a 15-mil vapor retarder (Stego-Wrap or equivalent), provided that the concrete mix uses a low-water cement ratio and concrete curing methods are employed to compensate for release of bleed water through the top of the slab. For areas with moisture sensitive flooring materials, the concrete slab should be placed directly on a 15-mil vapor retarder constructed in accordance with ASTM E1643 and E1745.

Structural concrete slab reinforcement should consist of chaired rebar slab reinforcement (minimum of No. 3 bars at 16-inch centers, both horizontal directions) placed at slab mid-height to resist potential swell forces and cracking. Slab thickness and steel reinforcement are minimums only and should be verified by the structural engineer/designer knowing the actual project loadings.

All steel components of the foundation system should be protected from corrosion by maintaining a 3-inch minimum concrete cover of densely consolidated concrete at footings (by use of a vibrator). The construction joint between the foundation and any mowstrips/sidewalks placed adjacent to foundations should be sealed with a polyurethane based non-hardening sealant to prevent moisture migration between the joint.

Epoxy coated embedded steel components (ASTM D3963/A934) or permanent waterproofing membranes placed at the exterior footing sidewall may also be used to mitigate the corrosion potential of concrete placed in contact with native soil.

Control joints should be provided in all concrete slabs-on-grade at a maximum spacing (in feet) of 2 to 3 times the slab thickness (in inches) as recommended by American Concrete Institute (ACI) guidelines.

All joints should form approximately square patterns to reduce randomly oriented contraction cracks. Contraction joints in the slabs should be tooled at the time of the pour or sawcut (¼ of slab depth) within 6 to 8 hours of concrete placement.

Construction (cold) joints in foundations and area flatwork should either be thickened butt-joints with dowels or a thickened keyed-joint designed to resist vertical deflection at the joint. All joints in flatwork should be sealed to prevent moisture, vermin, or foreign material intrusion. Precautions should be taken to prevent curling of slabs in this arid desert region (refer to ACI guidelines).

Non-structural Concrete: All non-structural independent flatwork (sidewalks adjacent to the modular building foundation and uncovered patios) shall be a minimum of 4 inches thick and should be placed on a minimum of 24 inches of concrete sand or aggregate base, dowelled to the perimeter foundations where adjacent to the building to prevent separation and sloped 2% (sidewalks) or 1 to 2% (patios) away from the building.

Patio slabs with shade structures shall have an 18-inch deep perimeter footing and shall have interior grade beams at 15 feet on center. Planters that trap water between sidewalks and foundations are not allowed.

A minimum of 24 inches of moisture conditioned (5% minimum above optimum) and 8 inches of compacted subgrade (85 to 90%) should underlie all independent flatwork. Flatwork which contains steel reinforcing (except wire mesh) should be underlain by a 10-mil (minimum) polyethylene separation sheet and at least a 2-inch sand cover. All flatwork should be jointed in square patterns and at irregularities in shape at a maximum spacing of 8 feet or the least width of the sidewalk.

5.4 Concrete Mixes and Corrosivity

Selected chemical analyses for corrosivity were conducted on samples from the project site (Plate C-3). The native soils were found to have low sulfate ion concentrations (979 ppm). Sulfate ions in high concentrations can attack the cementitious material in concrete, causing weakening of the cement matrix and eventual deterioration by raveling.

The following table provides American Concrete Institute (ACI) recommended cement types, water-cement ratio and minimum compressive strengths for concrete in contact with soils:

Concrete Mix Design Criteria due to Soluble Sulfate Exposure

Sulfate Exposure Class	Water-soluble Sulfate (SO ₄) in soil, ppm	Cement Type	Maximum Water-Cement Ratio by weight	Minimum Strength f _c (psi)
S0	0-1,000	–	–	–
S1	1,000-2,000	II	0.50	4,000
S2	2,000-20,000	V	0.45	4,500
S3	Over 20,000	V (plus Pozzolon)	0.45	4,500

Note: From ACI 318-14 Table 19.3.1.1 and Table 19.3.2.1

However, in consideration of general corrosive environment in the vicinity, a minimum of 6.0 sacks per cubic yard of concrete (4,500 psi) of Type V Portland Cement with a maximum water/cement ratio of 0.45 (by weight) should be used for concrete placed in contact with native soil on this project (sitework including sidewalks, hardscape areas, and foundations). Admixtures may be required to allow placement of this low water/cement ratio concrete. Thorough concrete consolidation and hard trowel finishes should be used due to the aggressive soil exposure.

The native soils were also found to have low chloride ion concentrations (180 ppm). Chloride ions can cause corrosion of reinforcing steel and buried utilities. Resistivity determinations on the soils indicate severe potential for metal loss due to electrochemical corrosion processes.

Mitigation of the corrosion of steel can either be achieved by using steel pipes coated with epoxy corrosion inhibitors, asphaltic coatings, cathodic protection or by encapsulating the portion of the pipe with densely consolidated concrete. A minimum concrete cover of three (3) inches should be provided around steel reinforcing or embedded components exposed to native soil or landscape water (to 18 inches above grade). Additionally, the concrete should be thoroughly vibrated during placement to decrease the permeability of the concrete.

Due to the potential for corrosion of metallic piping, all water supply lines should be placed overhead, not beneath the slab. No portion of metallic piping on site should be placed in direct contact with native soils. Copper water lines shall be wrapped or fully encapsulated prior to installation in native soils. A corrosion engineer should be consulted to obtain final design recommendations.

5.5 Excavations

Temporary excavations in native clay soils should stand nearly vertical for short duration. The contractor is solely responsible for the safety of workers entering excavations and trenches. Temporary excavations deeper than 5 feet should be shored or sloped at 1.5 to 1 (horizontal to vertical). Groundwater is anticipated to be encountered at a depth of approximately 8 feet below ground surface.

Surcharge loads of stockpiled soils or construction materials and equipment should be set back from the top of the slopes a minimum distance equal to 10 feet or the height of the slope (whichever is greatest). Permanent slopes should not be steeper than 3 to 1 (horizontal to vertical) to reduce wind and rain erosion.

5.6 Utility Trench Backfill

Utility Trench Backfill: Prior to placement of utility bedding, the exposed subgrade at the bottom of trench excavations should be examined for soft, loose, or unstable soil. Loose materials at trench bottoms resulting from excavation disturbance should be removed to firm material. If extensive soft or unstable areas are encountered, these areas should be over-excavated to a depth of at least 2 feet or to a firm base and be replaced with additional bedding material.

Backfill Materials: Pipe zone backfill (i.e., material beneath and in the immediate vicinity of the pipe) should consist of a 4 to 8 inch bed of $\frac{3}{8}$ -inch crushed rock, sand/cement slurry (3 sack cement factor), and/or crusher fines (sand) extending to a minimum of 12 inches above the top of pipe. If crushed rock is used for pipe zone backfill for utilities, the crushed rock material should be completely surrounded by a non-woven filter fabric such as Mirafi 140N or equivalent. The filter fabric shall cover the trench bottom, sidewalls and over the top of the crushed rock. The filter fabric is recommended to inhibit the migration of fine material into void spaces in the crushed rock which may create the potential for sinkholes or depressions to develop at the ground surface.

Pipe bedding should be in accordance with pipe manufacturer's recommendations. Recommendations provided above for pipe zone backfill are minimum requirements only.

More stringent material specifications may be required to fulfill local codes and/or bedding requirements for specific types of pipes.

On-site soil free of debris, vegetation, and other deleterious matter may be suitable for use as utility trench backfill above pipezone, but may be difficult to uniformly maintain at specified moistures and compact to the specified densities. Native backfill should only be placed and compacted after encapsulating buried pipes with suitable bedding and pipe envelope material.

Compaction Criteria: Mechanical compaction is recommended; ponding or jetting should not be allowed, especially in areas supporting structural loads or beneath concrete slabs supported-on-grade, pavements, or other improvements. All trench backfill should be placed and compacted in accordance with recommendations provided above for engineered fill.

The pipe zone material (crusher fines, sand) shall be compacted to a minimum of 95% of ASTM D1557 maximum dry density. Pipe deflection should be checked to not exceed 2% of pipe diameter. Native clay/silt soils may be used to backfill the remainder of the trench. Soils used for trench backfill shall be placed in maximum 6 inch lifts (loose), compacted to a minimum of 90% of ASTM D1557 maximum dry density at a minimum of 4% above optimum moisture.

Imported granular material is acceptable for backfill of utility trenches. Granular trench backfill used in building pad areas should be plugged with a solid (no clods or voids) 2-foot width of native clay soils at each end of the building foundation to prevent landscape water migration into the trench below the building.

Backfill soil of utility trenches within paved areas should be uniformly moisture conditioned to a minimum of 4% above optimum moisture, placed in layers not more than 6 inches in thickness and mechanically compacted to a minimum of 90% of the ASTM D1557 maximum dry density, except that the top 12 inches shall be compacted to 95% (if granular trench backfill).

5.6 Seismic Design

This site is located in the seismically active southern California area and the site structures are subject to strong ground shaking due to potential fault movements along the Superstition Hills, Imperial and Brawley faults. Engineered design and earthquake-resistant construction are the common solutions to increase safety and development of seismic areas. Designs should comply with the latest edition of the CBC for Site Class D using the seismic coefficients given in Section 3.5 and Tables 4 of this report.

Section 6

LIMITATIONS AND ADDITIONAL SERVICES

6.1 Limitations

The professional opinions and conclusions within this report are based on current information regarding the proposed construction of a 4,320 square foot modular building located on the northeast portion of the Imperial Valley College campus located at 380 East Aten Road in Imperial, California. The conclusions of this report are invalid if:

- Structural loads change from those stated or the structures are relocated.
- The Additional Services section of this report is not followed.
- This report is used for adjacent or other property.
- Changes of grade or groundwater occur between the issuance of this report and construction other than those anticipated in this report.
- Any other change that materially alters the project from that proposed at the time this report was prepared.

We have based our findings and professional opinions in this report on selected points of field exploration, laboratory testing, and our understanding of the proposed project. Furthermore, findings and professional opinions are based on the assumption that soil conditions do not vary significantly from those found at specific exploratory locations. Variations in soil conditions could exist between and beyond the exploration points and groundwater conditions may change. These conditions may require additional studies, consultation, and possible design revisions.

This report contains information that may be useful in the preparation of contract specifications. However, the report is not worded in such a manner that we recommend its use as a construction specification document without proper modification. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

This report was prepared according to the generally accepted *geotechnical engineering standards of practice* that existed in Imperial County at the time the report was prepared. No warranty, express or implied, is made in connection with our services. Because of potential changes in the Geotechnical Engineering Standards of Practice, this report should be considered invalid for periods after three years from the report date without a review of the validity of the findings and professional opinions by our firm.

The client has responsibility to see that all parties to the project including designer, contractor, subcontractor, and future owners are made aware of this entire report. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

6.2 Additional Services

The professional opinions presented in this report are based on the assumption that an adequate program of tests and observations will be conducted during construction to check the field subsurface conditions and compliance of the professional opinions that are the basis of this report. *The geotechnical engineering firm providing the tests and observations shall assume the responsibility of geotechnical engineer of record.*

Additional tests and observations should include, but not necessarily be limited to the following:

- Review of project plans and specifications, prior to their issuance for bidding, to check for compatibility with our professional opinions and conclusions;
- Observation and testing by the geotechnical consultant of record during site clearing, grading, excavation, placement of fills, building pad and subgrade preparation, and backfilling of utility trenches;
- Observation of foundation excavations and reinforcing steel before concrete placement;
- Consultation as may be required during construction.

Additional information concerning the scope and cost of these services can be obtained from our office.

Section 7

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TABLES

Table 1
Summary of Characteristics of Closest Known Active Faults

Fault Name	Approximate Distance (miles)	Approximate Distance (km)	Maximum Moment Magnitude (Mw)	Fault Length (km)	Slip Rate (mm/yr)
Imperial	0.2	0.4	7	62 ± 6	20 ± 5
Brawley *	1.7	2.8			
Superstition Hills	5.8	9.3	6.6	23 ± 2	4 ± 2
Rico *	6.1	9.7			
Superstition Mountain	11.3	18.1	6.6	24 ± 2	5 ± 3
Unnamed 2*	14.4	23.1			
Unnamed 1*	15.5	24.8			
Yuha*	17.4	27.8			
Shell Beds	19.8	31.6			
Yuha Well *	20.0	31.9			
Borrego (Mexico)*	20.9	33.5			
Laguna Salada	22.1	35.3	7	67 ± 7	3.5 ± 1.5
Cerro Prieto *	22.6	36.1			
Vista de Anza*	23.3	37.2			
Painted Gorge Wash*	23.6	37.8			
Elmore Ranch	24.2	38.8	6.6	29 ± 3	1 ± 0.5
Pescadores (Mexico)*	25.4	40.6			
Cucapah (Mexico)*	26.3	42.1			
Ocotillo*	27.4	43.9			
Elsinore - Coyote Mountain	30.8	49.2	6.8	39 ± 4	4 ± 2
San Jacinto - Borrego	31.0	49.7	6.6	29 ± 3	4 ± 2
Algodones *	32.7	52.3			

* Note: Faults not included in CGS database.

Table 2
2019 California Building Code (CBC) and ASCE 7-16
General Procedure Ground Motion Parameters

Soil Site Class:	D	<u>ASCE 7-16 Reference</u>
Latitude:	32.8297 N	Table 20.3-1
Longitude:	-115.5031 W	
Risk Category:	III	
Seismic Design Category:	E	

Maximum Considered Earthquake (MCE) Ground Motion

Mapped MCE _R Short Period Spectral Response	S_s	2.251 g	ASCE Figure 22-1
Mapped MCE _R 1 second Spectral Response	S₁	0.802 g	ASCE Figure 22-2
Short Period (0.2 s) Site Coefficient	F_a	1.00	ASCE Table 11.4-1
Long Period (1.0 s) Site Coefficient	F_v	1.70	ASCE Table 11.4-2
MCE _R Spectral Response Acceleration Parameter (0.2 s)	S_{MS}	2.251 g	= F _a * S _s ASCE Equation 11.4-1
MCE _R Spectral Response Acceleration Parameter (1.0 s)	S_{MI}	1.363 g	= F _v * S ₁ ASCE Equation 11.4-2

Design Earthquake Ground Motion

Design Spectral Response Acceleration Parameter (0.2 s)	S_{DS}	1.501 g	= 2/3*S _{MS}	ASCE Equation 11.4-3
Design Spectral Response Acceleration Parameter (1.0 s)	S_{DI}	0.909 g	= 2/3*S _{MI}	ASCE Equation 11.4-4
Risk Coefficient at Short Periods (less than 0.2 s)	C_{RS}	0.949		ASCE Figure 22-17
Risk Coefficient at Long Periods (greater than 1.0 s)	C_{RI}	0.923		ASCE Figure 22-18
	T_L	8.00 sec		ASCE Figure 22-12
	T_O	0.12 sec	= 0.2*S _{DI} /S _{DS}	
	T_S	0.61 sec	= S _{DI} /S _{DS}	
Peak Ground Acceleration	PGA_M	1.03 g		ASCE Equation 11.8-1

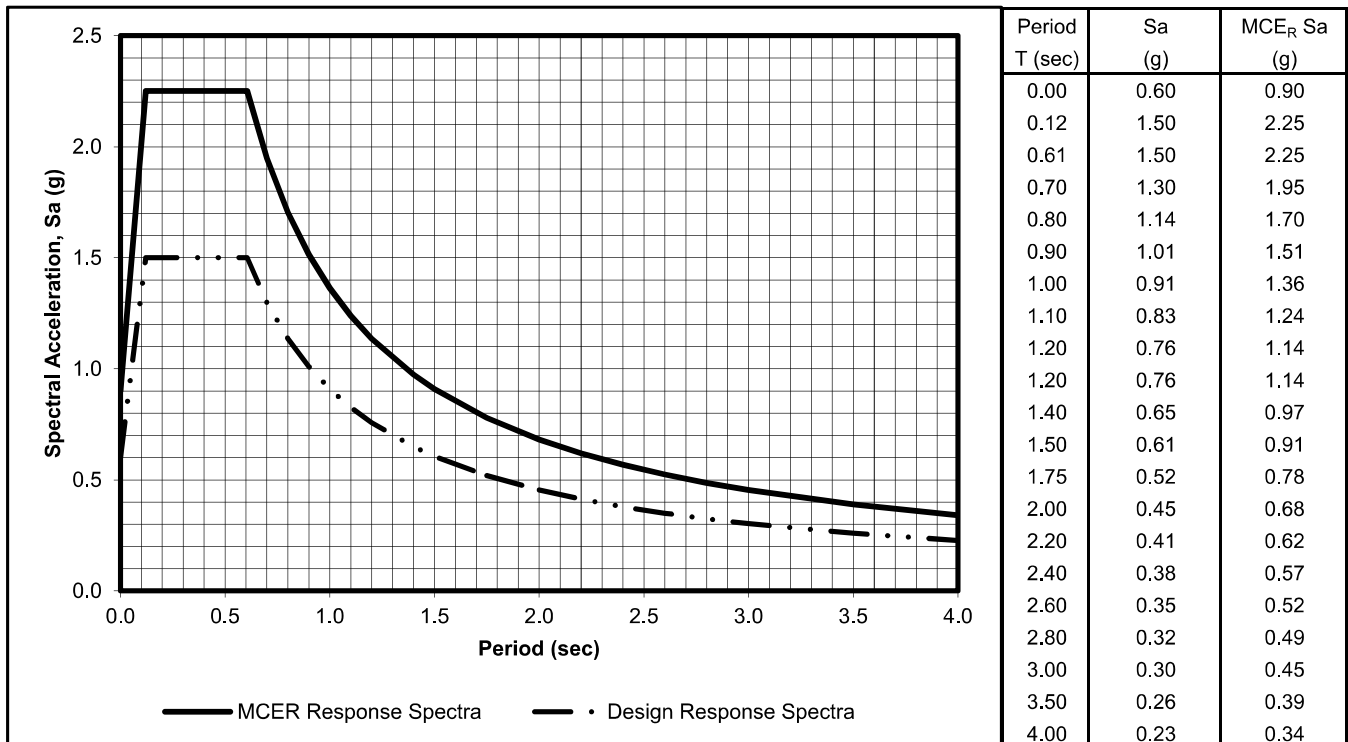


Table 3: Data for Site Specific Response Spectrum

Period	2% in 50 Years Probabilistic Spectrum (g) per ASCE 7-16 §21.2.1.1 Method 1	Risk Coefficients per ASCE 7-16 §21.2.1.1 Method 1	Probabilistic (MCE _R) Ground Motions per ASCE 7-16 §21.2.1.1 Method 1	84 th Percentile Deterministic (MCE _R) Ground Motions per ASCE 7-16 §21.2.2	Site-Specific MCE _R (S _{am}) per ASCE 7-16 §21.2.3	80% of 2016 CBC General Spectrum (g) per ASCE 7-16 §21.3	S _a = (2/3)S _{am} per ASCE 7-16 §21.3	S _a = (2/3)S _{am} per ASCE 7-16 §11.4.6	80% of S _a = (2/3)S _{am} per ASCE 7-16 §11.4.6	Design Response Spectrum per ASCE 7-16 §21.3
0.00	1.49	0.949	1.42	0.84	0.84	0.48	0.56	0.60	0.48	0.56
0.01	1.53	0.949	1.45	0.85	0.85	0.54	0.57	0.65	0.52	0.57
0.02	1.56	0.949	1.48	0.87	0.87	0.60	0.58	0.70	0.56	0.58
0.04	1.62	0.949	1.54	0.90	0.90	0.72	0.60	0.80	0.64	0.64
0.06	1.75	0.949	1.66	0.96	0.96	0.84	0.64	0.90	0.72	0.72
0.08	1.95	0.949	1.85	1.04	1.04	0.96	0.70	1.00	0.80	0.80
0.10	2.14	0.949	2.03	1.13	1.13	1.07	0.75	1.11	0.88	0.88
0.12	2.27	0.949	2.16	1.21	1.21	1.19	0.81	1.21	0.97	0.97
0.14	2.41	0.949	2.28	1.29	1.29	1.20	0.86	1.31	1.05	1.05
0.16	2.54	0.949	2.41	1.37	1.37	1.20	0.91	1.41	1.13	1.13
0.18	2.67	0.949	2.54	1.45	1.45	1.20	0.96	1.50	1.20	1.20
0.20	2.80	0.949	2.66	1.52	1.52	1.20	1.02	1.50	1.20	1.20
0.22	2.83	0.948	2.67	1.55	1.55	1.20	1.04	1.50	1.20	1.20
0.24	2.87	0.948	2.70	1.58	1.58	1.20	1.05	1.50	1.20	1.20
0.26	2.90	0.947	2.73	1.61	1.61	1.20	1.07	1.50	1.20	1.20
0.28	2.93	0.946	2.76	1.64	1.64	1.20	1.09	1.50	1.20	1.20
0.30	2.96	0.946	2.78	1.67	1.67	1.20	1.11	1.50	1.20	1.20
0.32	2.98	0.945	2.80	1.68	1.68	1.20	1.12	1.50	1.20	1.20
0.34	3.00	0.944	2.82	1.70	1.70	1.20	1.13	1.50	1.20	1.20
0.36	3.01	0.944	2.84	1.71	1.71	1.20	1.14	1.50	1.20	1.20
0.38	3.03	0.943	2.85	1.73	1.73	1.20	1.15	1.50	1.20	1.20
0.40	3.05	0.943	2.87	1.74	1.74	1.20	1.16	1.50	1.20	1.20
0.42	3.05	0.942	2.87	1.75	1.75	1.20	1.16	1.50	1.20	1.20
0.44	3.05	0.941	2.87	1.75	1.75	1.20	1.17	1.50	1.20	1.20
0.46	3.06	0.941	2.87	1.75	1.75	1.20	1.17	1.50	1.20	1.20
0.48	3.06	0.940	2.87	1.76	1.76	1.20	1.17	1.50	1.20	1.20
0.50	3.06	0.939	2.87	1.76	1.76	1.20	1.17	1.50	1.20	1.20
0.52	3.04	0.939	2.86	1.75	1.75	1.20	1.17	1.50	1.20	1.20
0.54	3.03	0.938	2.85	1.75	1.75	1.20	1.16	1.50	1.20	1.20
0.56	3.02	0.937	2.83	1.74	1.74	1.20	1.16	1.50	1.20	1.20
0.58	3.00	0.937	2.82	1.73	1.73	1.20	1.16	1.50	1.20	1.20
0.60	2.99	0.936	2.80	1.73	1.73	1.20	1.15	1.50	1.20	1.20
0.62	2.97	0.935	2.79	1.72	1.72	1.17	1.15	1.50	1.20	1.20
0.64	2.96	0.935	2.77	1.72	1.72	1.14	1.14	1.50	1.20	1.20
0.66	2.95	0.934	2.76	1.71	1.71	1.10	1.14	1.50	1.20	1.20
0.68	2.93	0.933	2.74	1.70	1.70	1.07	1.14	1.50	1.20	1.20
0.70	2.92	0.933	2.73	1.70	1.70	1.04	1.13	1.50	1.20	1.20
0.72	2.90	0.932	2.71	1.69	1.69	1.01	1.13	1.50	1.20	1.20
0.74	2.89	0.931	2.70	1.69	1.69	0.98	1.12	1.50	1.20	1.20
0.75	2.88	0.931	2.69	1.68	1.68	0.97	1.12	1.50	1.20	1.20
0.80	2.84	0.930	2.65	1.66	1.66	0.91	1.11	1.50	1.20	1.20
0.85	2.80	0.928	2.61	1.64	1.64	0.86	1.09	1.50	1.20	1.20
0.90	2.76	0.926	2.57	1.61	1.61	0.81	1.07	1.49	1.19	1.19
0.95	2.72	0.925	2.52	1.59	1.59	0.77	1.06	1.41	1.13	1.13
1.00	2.68	0.923	2.48	1.57	1.57	0.73	1.04	1.34	1.07	1.07
1.50	2.35	0.923	2.17	1.35	1.35	0.48	0.90	0.89	0.71	0.90
2.00	2.03	0.923	1.87	1.13	1.13	0.36	0.75	0.67	0.53	0.75
2.50	1.69	0.923	1.56	0.95	0.95	0.29	0.63	0.53	0.43	0.63
3.00	1.36	0.923	1.25	0.77	0.77	0.24	0.52	0.45	0.36	0.52
3.50	1.19	0.923	1.10	0.67	0.67	0.21	0.45	0.38	0.31	0.45
4.00	1.02	0.923	0.94	0.57	0.57	0.18	0.38	0.33	0.27	0.38

Table 4: Site-Specific Design Response Spectrum

Period	Site Specific MCE (g)	2/3 Site Specific MCE (g)	80% CBC General Spectrum	Design Response Spectrum (g)
0.00	0.84	0.56	0.48	0.56
0.05	0.91	0.61	0.68	0.68
0.10	1.13	0.75	0.88	0.88
0.12	1.21	0.81	0.97	0.97
0.20	1.52	1.02	1.20	1.20
0.25	1.60	1.06	1.20	1.20
0.30	1.67	1.11	1.20	1.20
0.35	1.71	1.14	1.20	1.20
0.40	1.74	1.16	1.20	1.20
0.45	1.75	1.17	1.20	1.20
0.50	1.76	1.17	1.20	1.20
0.55	1.74	1.16	1.20	1.20
0.65	1.71	1.14	1.20	1.20
0.70	1.70	1.13	1.20	1.20
0.75	1.68	1.12	1.20	1.20
0.80	1.66	1.11	1.20	1.20
0.90	1.61	1.07	1.19	1.19
1.00	1.57	1.04	1.07	1.07
1.50	1.35	0.90	0.71	0.90
2.00	1.13	0.75	0.53	0.75
2.50	0.95	0.63	0.43	0.63
3.00	0.77	0.52	0.36	0.52
3.50	0.67	0.45	0.31	0.45
4.00	0.57	0.38	0.27	0.38

FIGURES



Source: California Geological Survey 2010 Fault Activity Map of California
<http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html#>

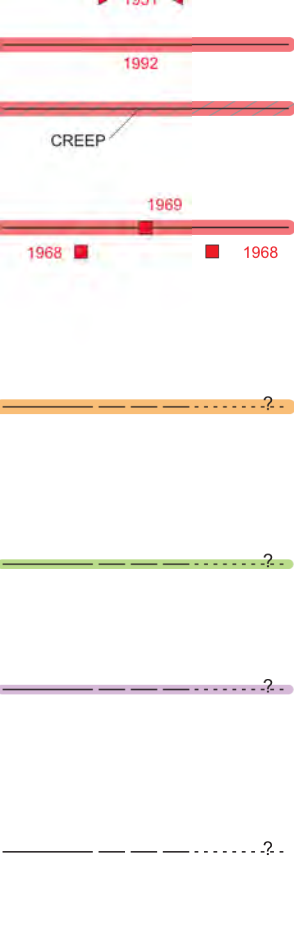
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Map of Local Faults

Figure 2



Source: California Geological Survey 2010 Fault Activity Map of California
<http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html#>



No triangle by date indicates an intermediate point along fault break.

Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

Square on fault indicates where fault creep slippage has occurred that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

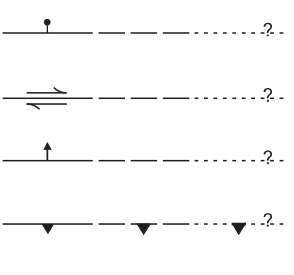
Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older than 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissance nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

ADDITIONAL FAULT SYMBOLS



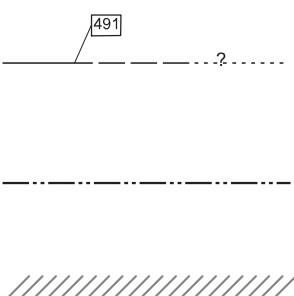
Bar and ball on downthrown side (relative or apparent).

Arrows along fault indicate relative or apparent direction of lateral movement.

Arrow on fault indicates direction of dip.

Low angle fault (barbs on upper plate). Fault surface generally dips less than 45° but locally may have been subsequently steepened. On offshore faults, barbs simply indicate a reverse fault regardless of steepness of dip.

OTHER SYMBOLS

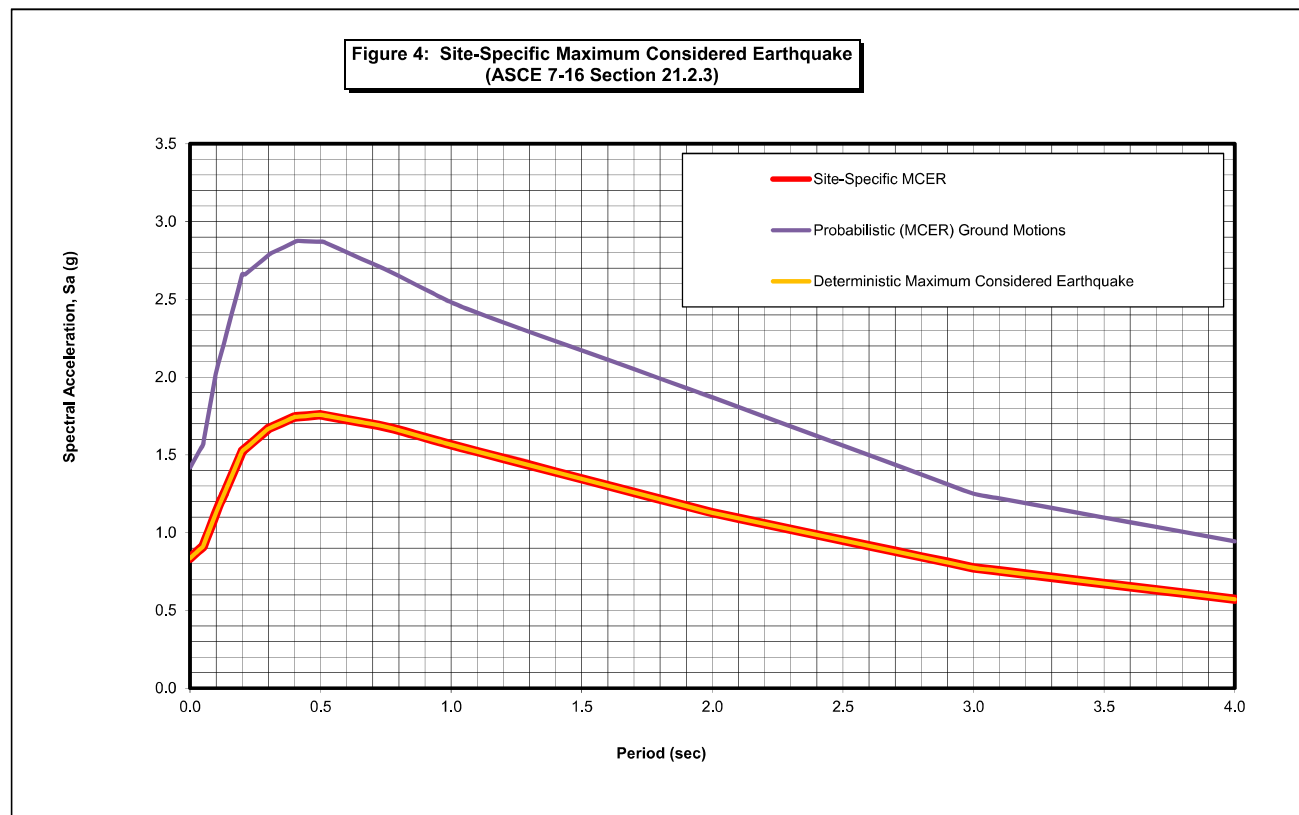
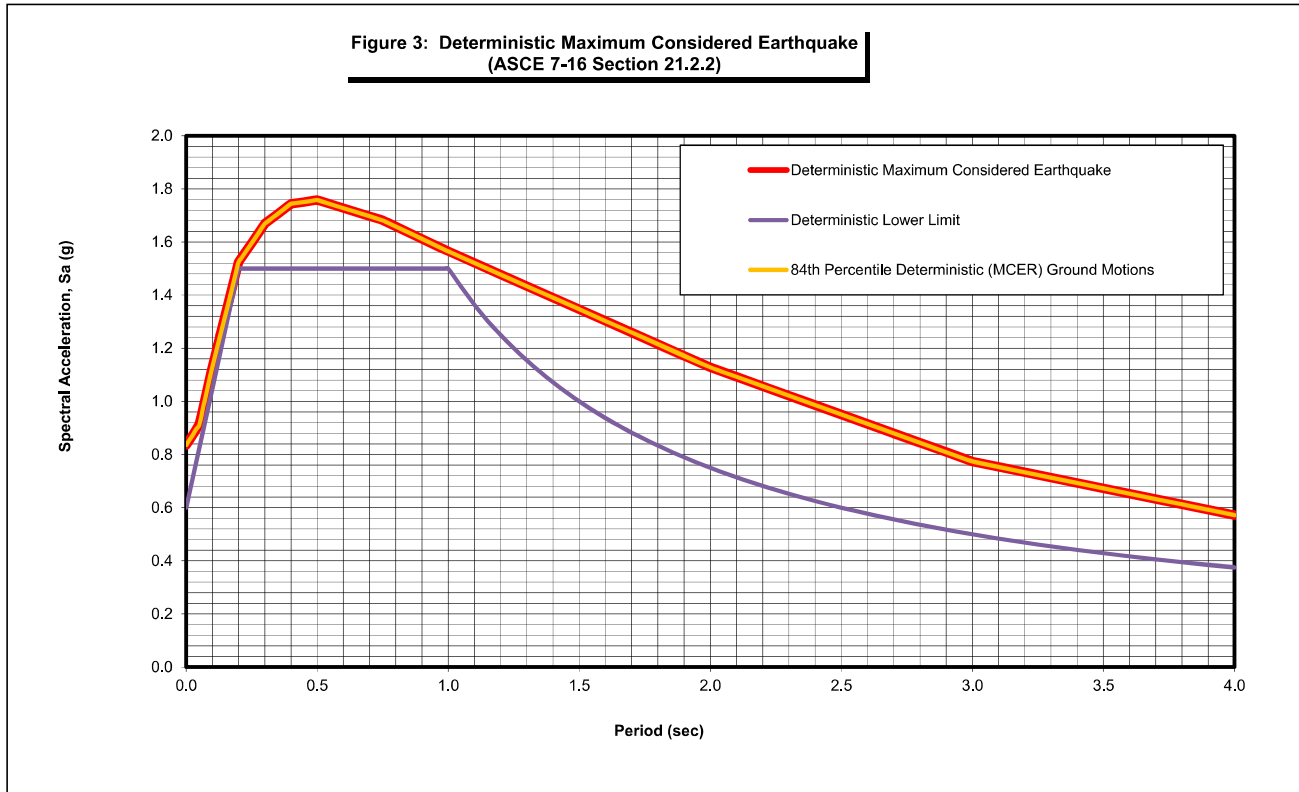


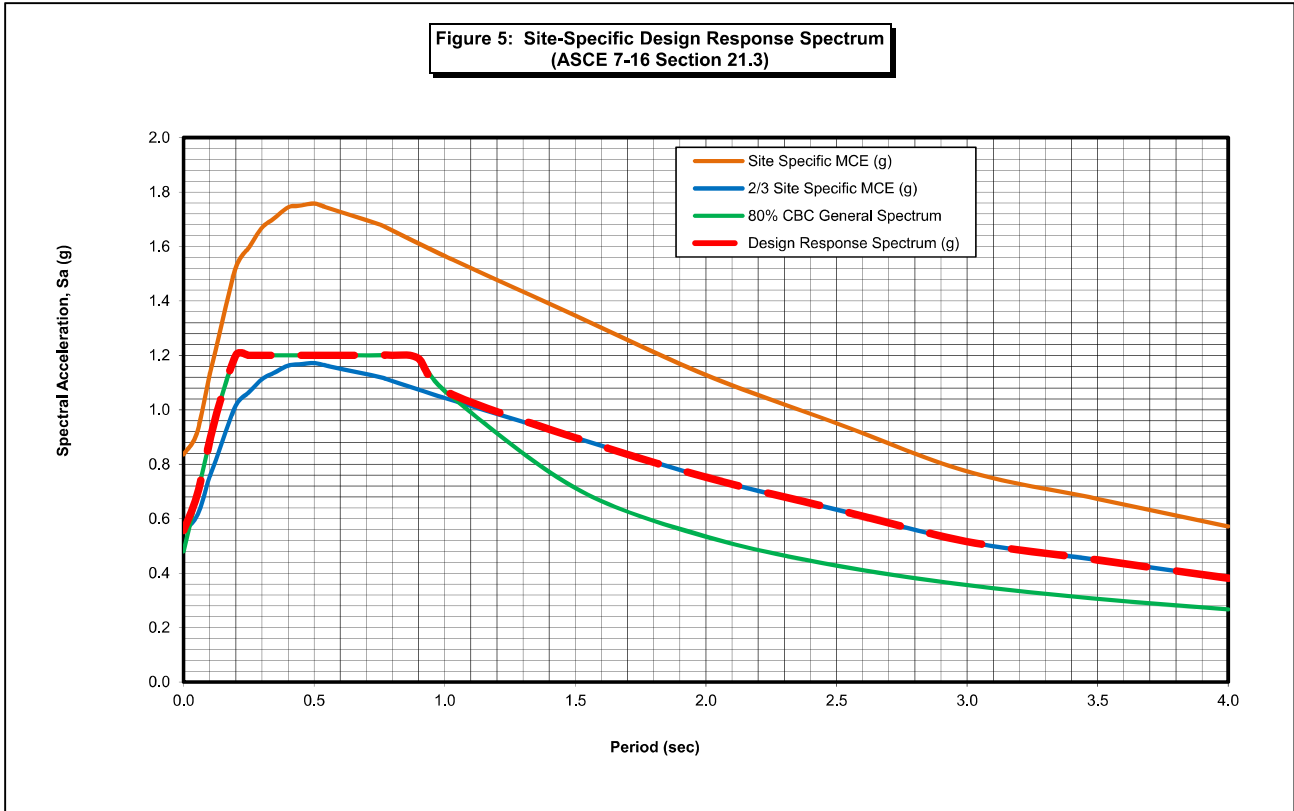
Numbers refer to annotations listed in the appendices of the accompanying report. Annotations include fault name, age of fault displacement, and pertinent references including Earthquake Fault Zone maps where a fault has been zoned by the Alquist-Priolo Earthquake Fault Zoning Act. This Act requires the State Geologist to delineate zones to encompass faults with Holocene displacement.

Structural discontinuity (offshore) separating differing Neogene structural domains. May indicate discontinuities between basement rocks.

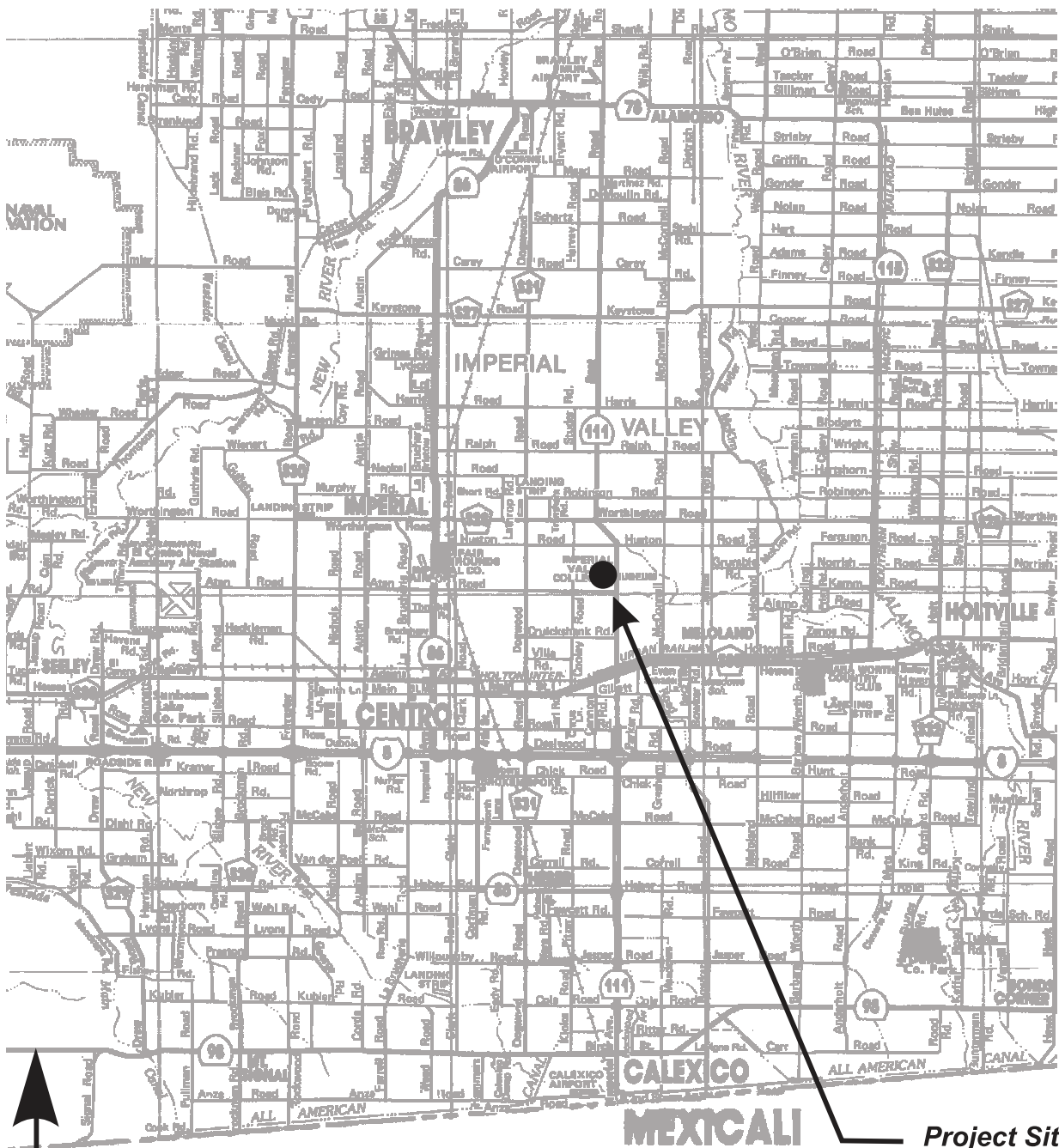
Brawley Seismic Zone, a linear zone of seismicity locally up to 10 km wide associated with the releasing step between the Imperial and San Andreas faults.

	Years			DESCRIPTION
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APPENDIX A



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Vicinity Map

Plate
 A-1



Site Location
 Lat: 32.8297 N
 Long: -115.5031 W

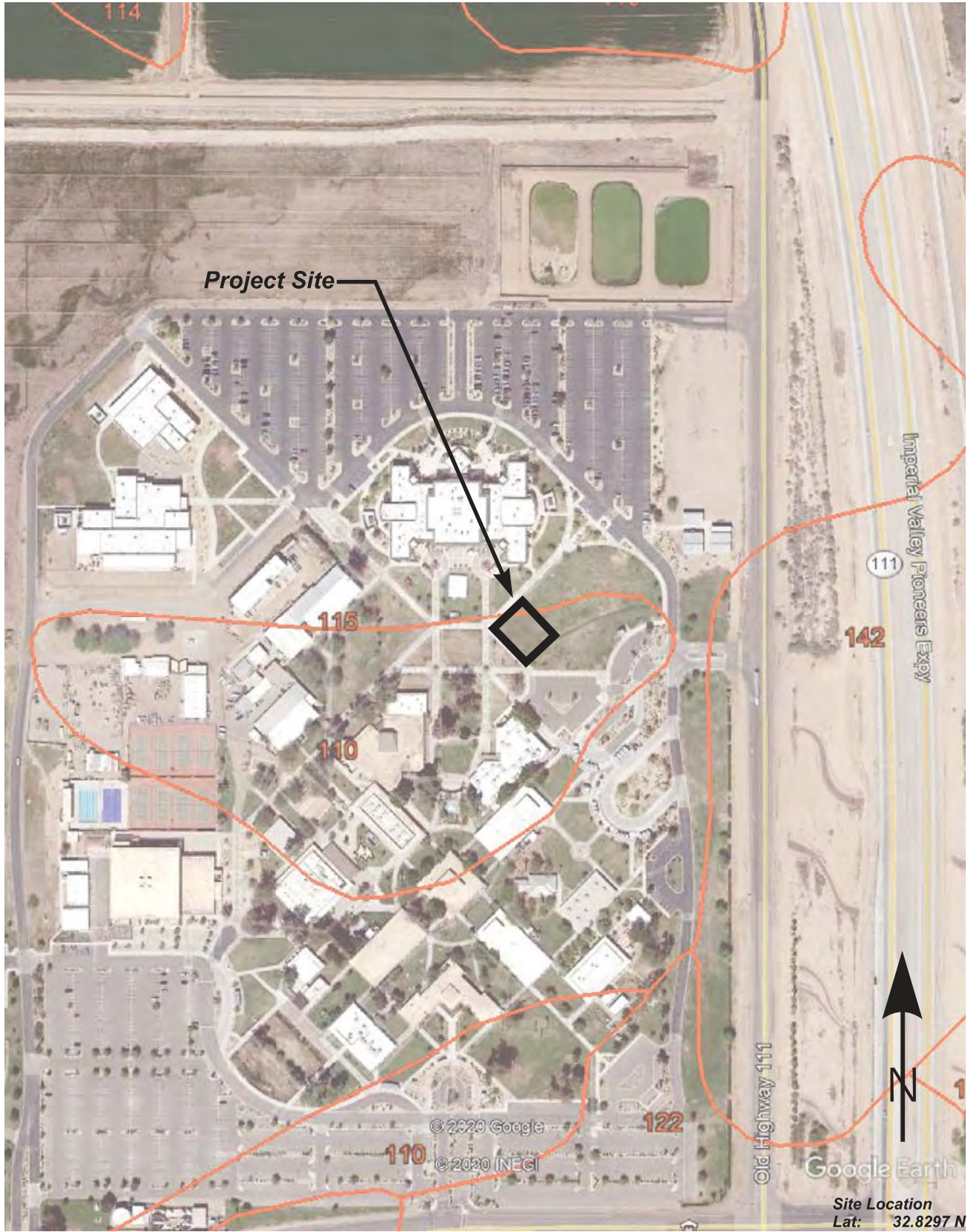
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Geo-Engineers and Geologists

Project No.: LE20064

Site and Exploration Map

Plate
 A-2



Site Location
Lat: 32.8297 N
Long: -115.5031W

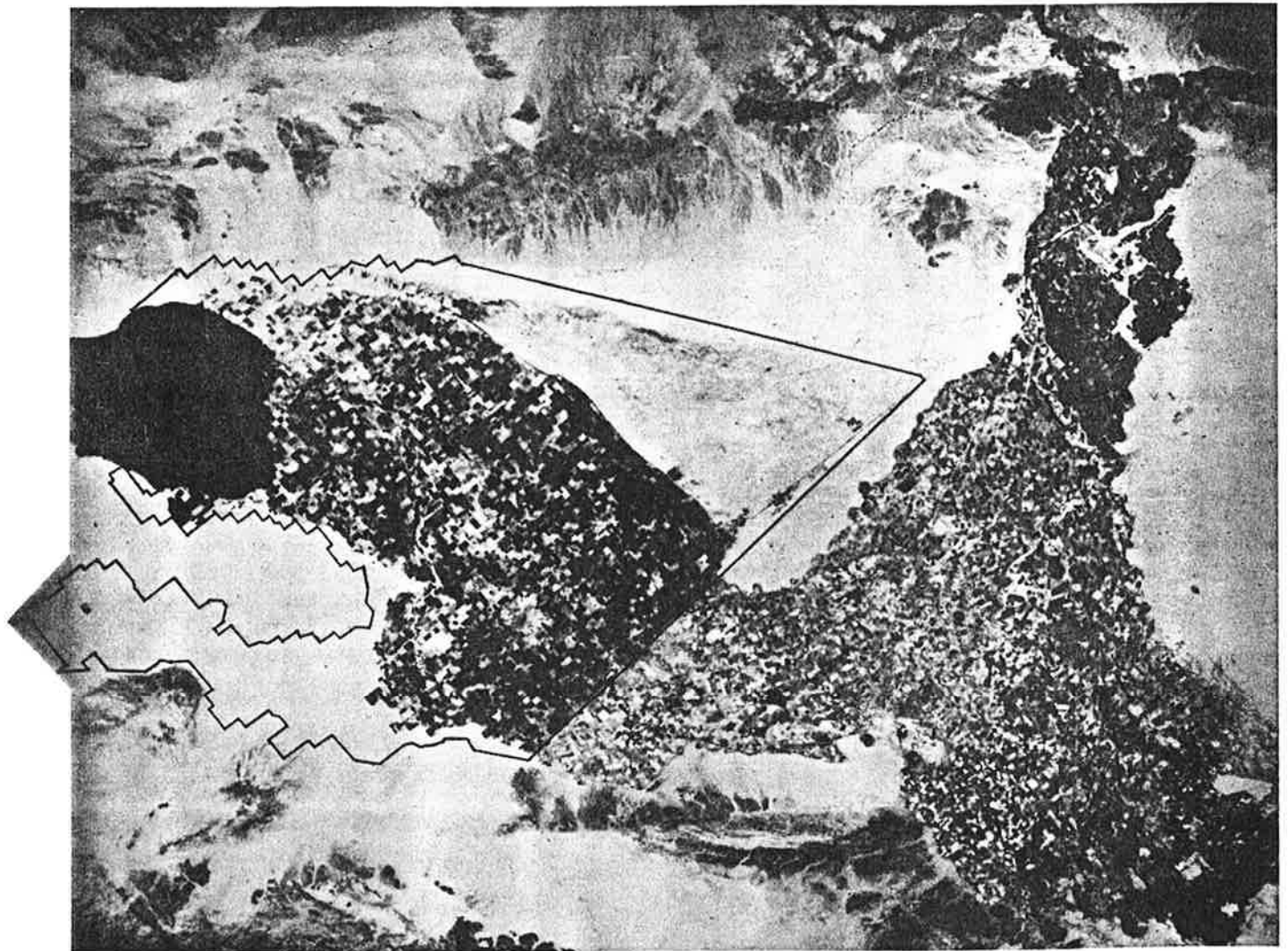
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Soil Survey Map

Plate
A-3

Soil Survey of

**IMPERIAL COUNTY
CALIFORNIA
IMPERIAL VALLEY AREA**



United States Department of Agriculture Soil Conservation Service
in cooperation with
University of California Agricultural Experiment Station
and
Imperial Irrigation District

TABLE 11.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
100-----	0-13	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
Antho	13-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
101*:											
Antho-----	0-8	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	8-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
Superstition-----	0-6	Fine sand-----	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
102*.											
Badland											
103-----	0-10	Gravelly sand---	SP, SP-SM	A-1, A-2	0-5	60-90	50-85	30-55	0-10	---	NP
Carsitas	10-60	Gravelly sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-5	60-90	50-85	25-50	0-10	---	NP
104*											
Fluvaquents											
105-----	0-13	Clay loam-----	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
Glenbar	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
106-----	0-13	Clay loam-----	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
Glenbar	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
107*-----	0-13	Loam-----	ML, CL-ML, CL	A-4	0	100	100	100	70-80	20-30	NP-10
Glenbar	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	75-95	35-45	15-30
108-----	0-14	Loam-----	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
Holtville	14-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
109-----	0-17	Silty clay-----	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
Holtville	17-24	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
110-----	0-17	Silty clay-----	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
Holtville	17-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth In	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
111*: Holtville-----	0-10	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	10-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
Imperial-----	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
112----- Imperial	0-12	Silty clay-----	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
113----- Imperial	0-12	Silty clay-----	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	100	85-95	50-70	25-45
114----- Imperial	0-12	Silty clay-----	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
115*: Imperial-----	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
Glenbar-----	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
116*: Imperial-----	0-13	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	13-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
Glenbar-----	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
117, 118----- Indio	0-12	Loam-----	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-72	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
119*: Indio-----	0-12	Loam-----	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-72	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
Vint-----	0-10	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	25-35	---	NP
	10-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
120*----- Laveen	0-12	Loam-----	ML, CL-ML	A-4	0	100	95-100	75-85	55-65	20-30	NP-10
	12-60	Loam, very fine sandy loam.	ML, CL-ML	A-4	0	95-100	85-95	70-80	55-65	15-25	NP-10

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

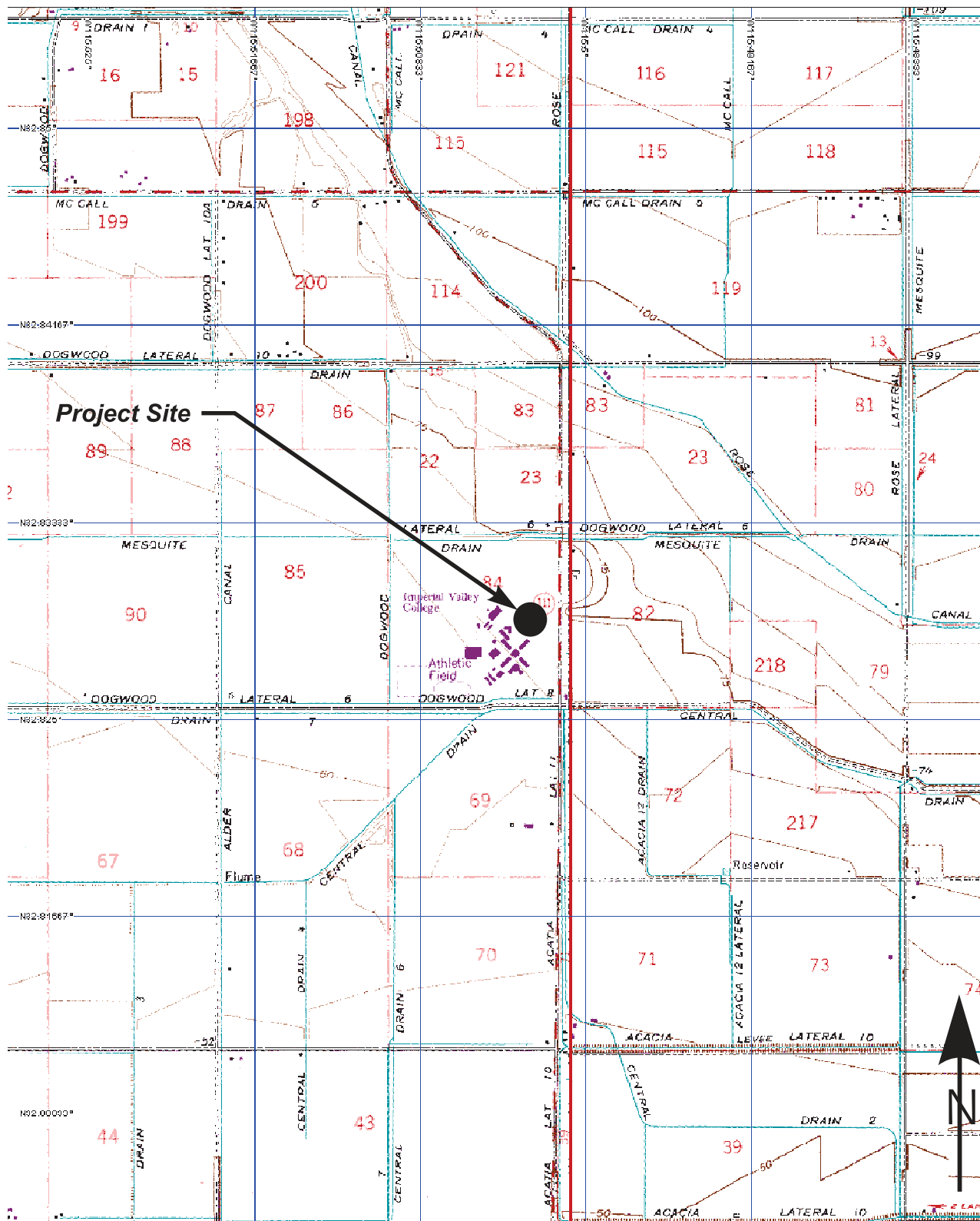
Soil name and map symbol	Depth In	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
121----- Meloland	0-12	Fine sand-----	SM, SP-SM	A-2, A-3	0	95-100	90-100	75-100	5-30	---	NP
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-65	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-40
122----- Meloland	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
123*: Meloland-----	0-12	Loam-----	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-38	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
	38-60	Stratified silt loam to loamy fine sand.	SM, ML	A-4	0	100	100	75-100	35-55	25-35	NP-10
Holtville-----	0-12	Loam-----	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	12-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-36	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	36-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
124, 125----- Niland	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
126----- Niland	0-23	Fine sand-----	SM, SP-SM	A-2, A-3	0	90-100	90-100	50-65	5-25	---	NP
	23-60	Silty clay-----	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
127----- Niland	0-23	Loamy fine sand	SM	A-2	0	90-100	90-100	50-65	15-30	---	NP
	23-60	Silty clay-----	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
128*: Niland-----	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-100	40-65	20-40
Imperial-----	0-12	Silty clay-----	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
129*: Pits											
130, 131----- Rositas	0-27	Sand-----	SP-SM	A-3, A-1, A-2	0	100	80-100	40-70	5-15	---	NP
	27-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
132, 133, 134, 135-Rositas	0-9	Fine sand-----	SM	A-3, A-2	0	100	80-100	50-80	10-25	---	NP
	9-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
136-----Rositas	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
137-----Rositas	0-12	Silt loam-----	ML	A-4	0	100	100	90-100	70-90	20-30	NP-5
	12-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
138*: Rositas-----	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
Superstition-----	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
139-----Superstition	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
140*: Torriorthents Rock outcrop											
141*: Torriorthents Orthids											
142-----Vint	0-10	Loamy very fine sand.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-60	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
143-----Vint	0-12	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-85	45-55	15-25	NP-5
	12-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
144*: Vint-----	0-10	Very fine sandy loam.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-40	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
	40-60	Silty clay-----	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
Indio-----	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-40	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	40-72	Silty clay-----	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35

* See description of the map unit for composition and behavior characteristics of the map unit.



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS

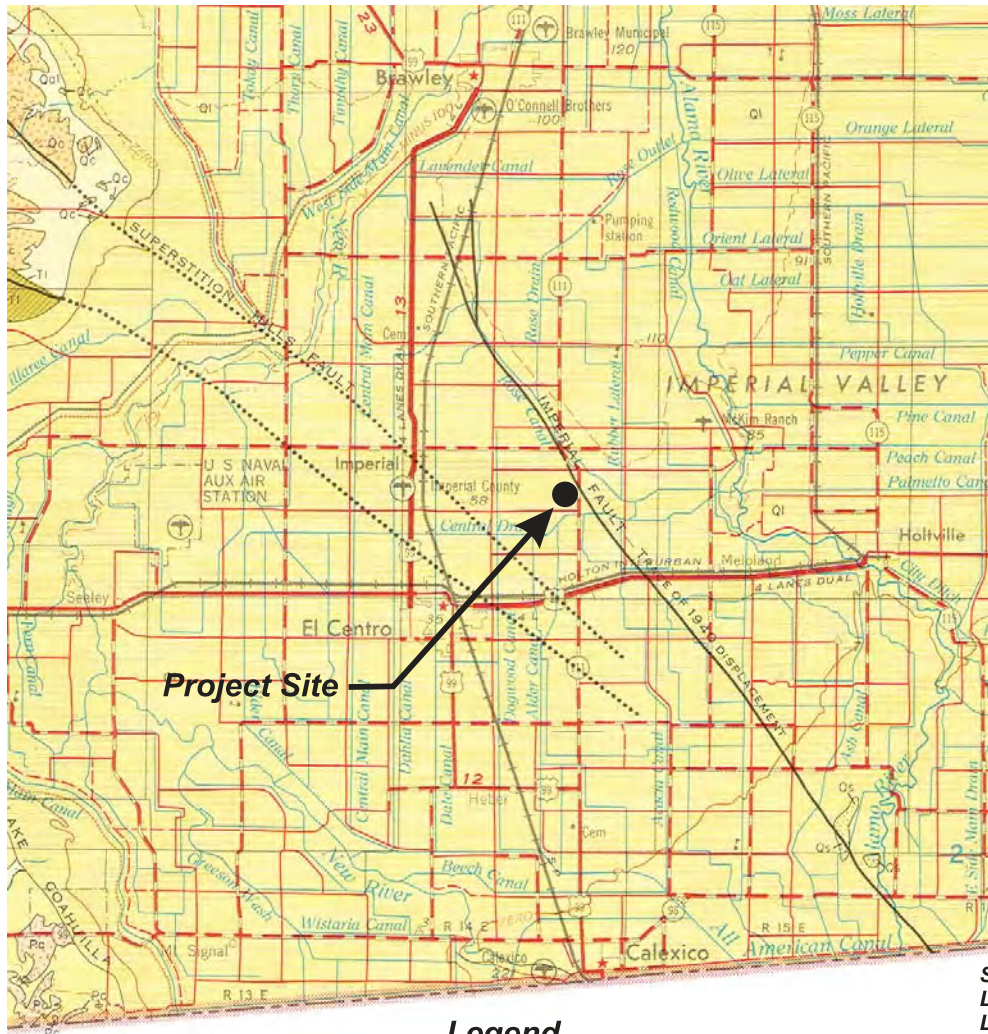
700 ft Scale: 1 : 24,000 Detail: 13-1 Datum: WGS84

Site Location
 Lat: 32.8297 N
 Long: -115.5031 W

LANDMARK
 Geo-Engineers and Geologists
 Project No.: LE20064

Topographic Map

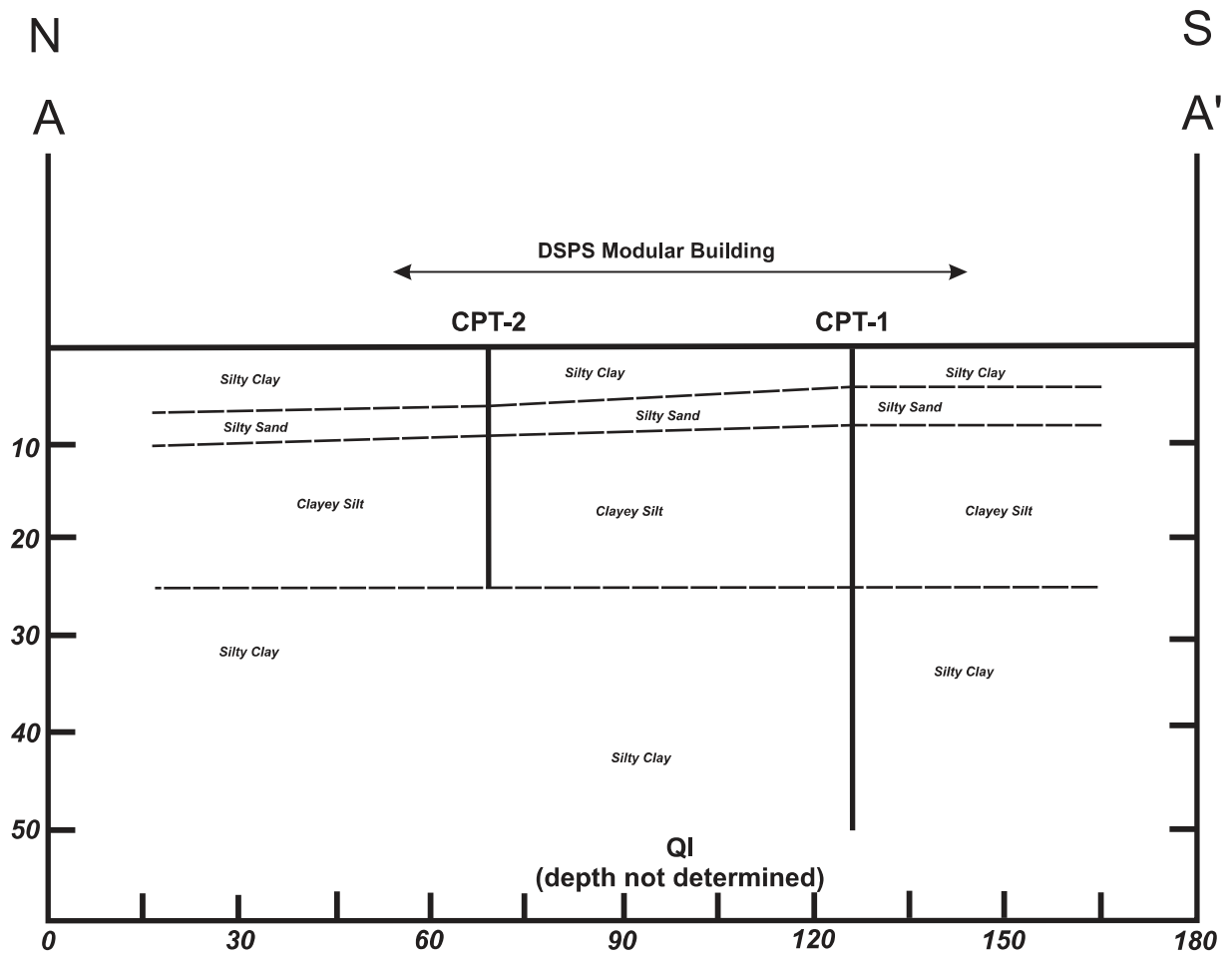
Plate
 A-4



Site Location
 Lat: 32.8297 N
 Long: -115.5031 W

Legend

<p>QUATERNARY</p> <p>Recent</p> <ul style="list-style-type: none"> Qs Dune sand Qal Alluvium Qsc Stream channel deposits Qf Fan deposits Qb Basin deposits Qst Salt deposits Ql Quaternary lake deposits Qg Glacial deposits Qn Quaternary nonmarine terrace deposits Qm Pleistocene marine and marine terrace deposits Qc Pleistocene nonmarine Qp Plio-Pleistocene nonmarine Qn Undivided Pliocene nonmarine Qup Upper Pliocene nonmarine Qum Upper Pliocene marine Qml Middle and/or lower Pliocene nonmarine Qpm Middle and/or lower Pliocene marine 		<p>Recent volcanic: Qv^r - rhyolite; Qv^a - andesite; Qv^b - basalt; Qv^p - pyroclastic rocks</p> <p>Pleistocene volcanic: Qv^r - rhyolite; Qv^a - andesite; Qv^b - basalt; Qv^p - pyroclastic rocks</p> <p>Quaternary and/or Pliocene cinder cones</p> <p>Pliocene volcanic: P^r - rhyolite; P^a - andesite; P^b - basalt; P^p - pyroclastic rocks</p>	
<p>QUATERNARY</p> <p>Pliocene</p> <p>Eocene</p> <p>Oligocene</p> <p>Miocene</p>		<p>UNDIVIDED MIocene nonmarine</p> <p>UPPER MIocene nonmarine</p> <p>UPPER MIocene marine</p> <p>MIDDLE MIocene nonmarine</p> <p>MIDDLE MIocene marine</p> <p>LOWER MIocene marine</p> <p>OLIGOCENE nonmarine</p> <p>OLIGOCENE marine</p> <p>Eocene nonmarine</p> <p>Eocene marine</p> <p>Paleocene nonmarine</p> <p>Paleocene marine</p> <p>Cenozoic nonmarine</p> <p>Tertiary nonmarine</p> <p>Tertiary lake deposits</p> <p>Tertiary marine</p>	<p>Miocene volcanic: M^r - rhyolite; M^a - andesite; M^b - basalt; M^p - pyroclastic rocks</p> <p>Oligocene volcanic: O^r - rhyolite; O^a - andesite; O^b - basalt; O^p - pyroclastic rocks</p> <p>Eocene volcanic: E^r - rhyolite; E^a - andesite; E^b - basalt; E^p - pyroclastic rocks</p> <p>Cenozoic volcanic: C^r - rhyolite; C^a - andesite; C^b - basalt; C^p - pyroclastic rocks</p> <p>Tertiary granitic rocks</p> <p>Tertiary intrusive (hypabyssal) rocks: T^r - rhyolite; T^b - andesite; T^s - basalt</p> <p>Tertiary volcanic: T^r - rhyolite; T^a - andesite; T^b - basalt; T^p - pyroclastic rocks</p>



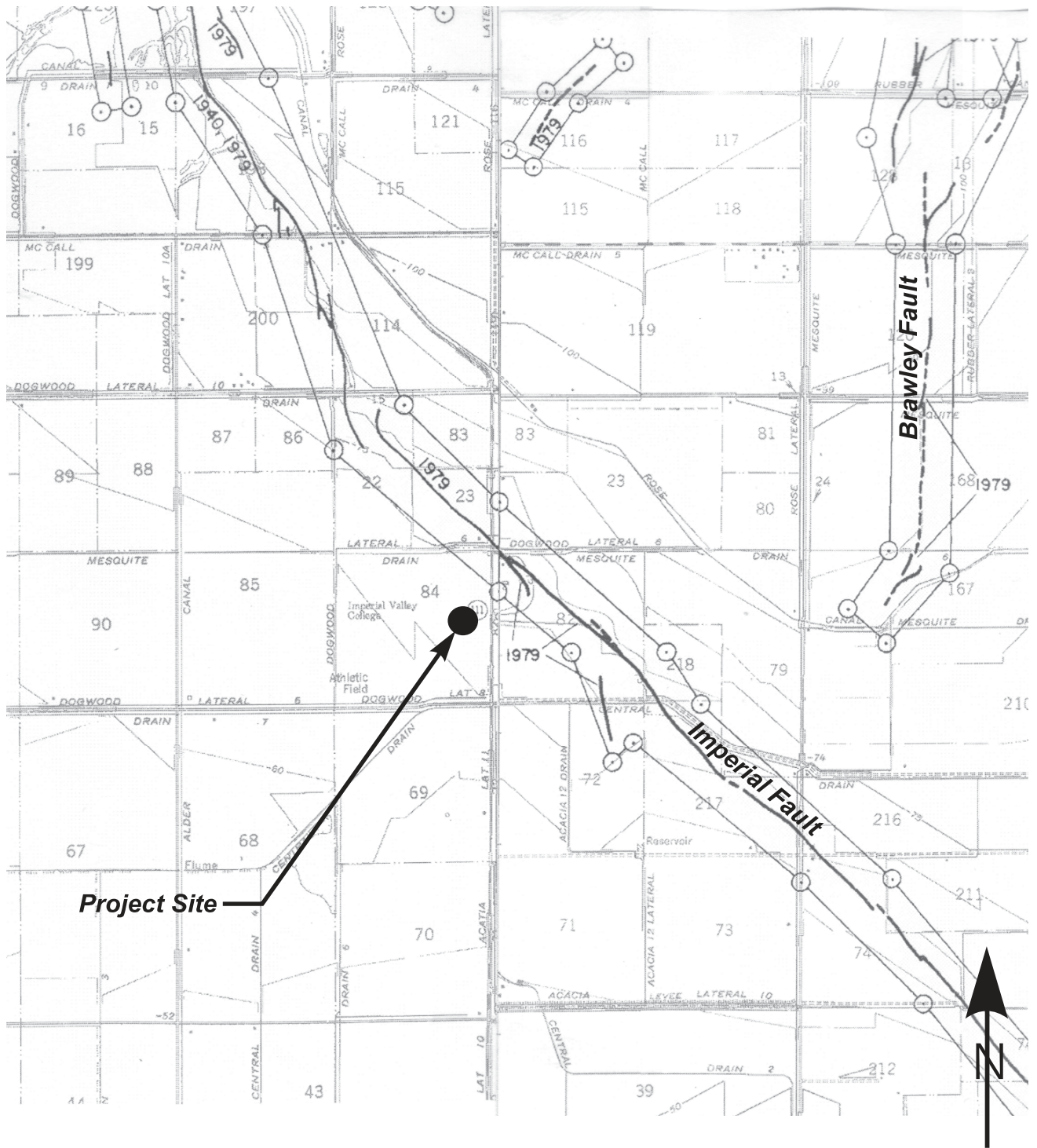
Scale
 1" = 30' Horizontal
 1" = 20' Vertical

LANDMARK
 Geo-Engineers and Geologists

Project No.: LE20064

Schematic Geologic
 Cross-section (A-A')

Plate
 A-6



Project Site

Site Location
 Lat: 32.8297 N
 Long: -115.5031 W

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A-P Earthquake Fault Map

Plate
A-7



Project Site

Imperial Fault

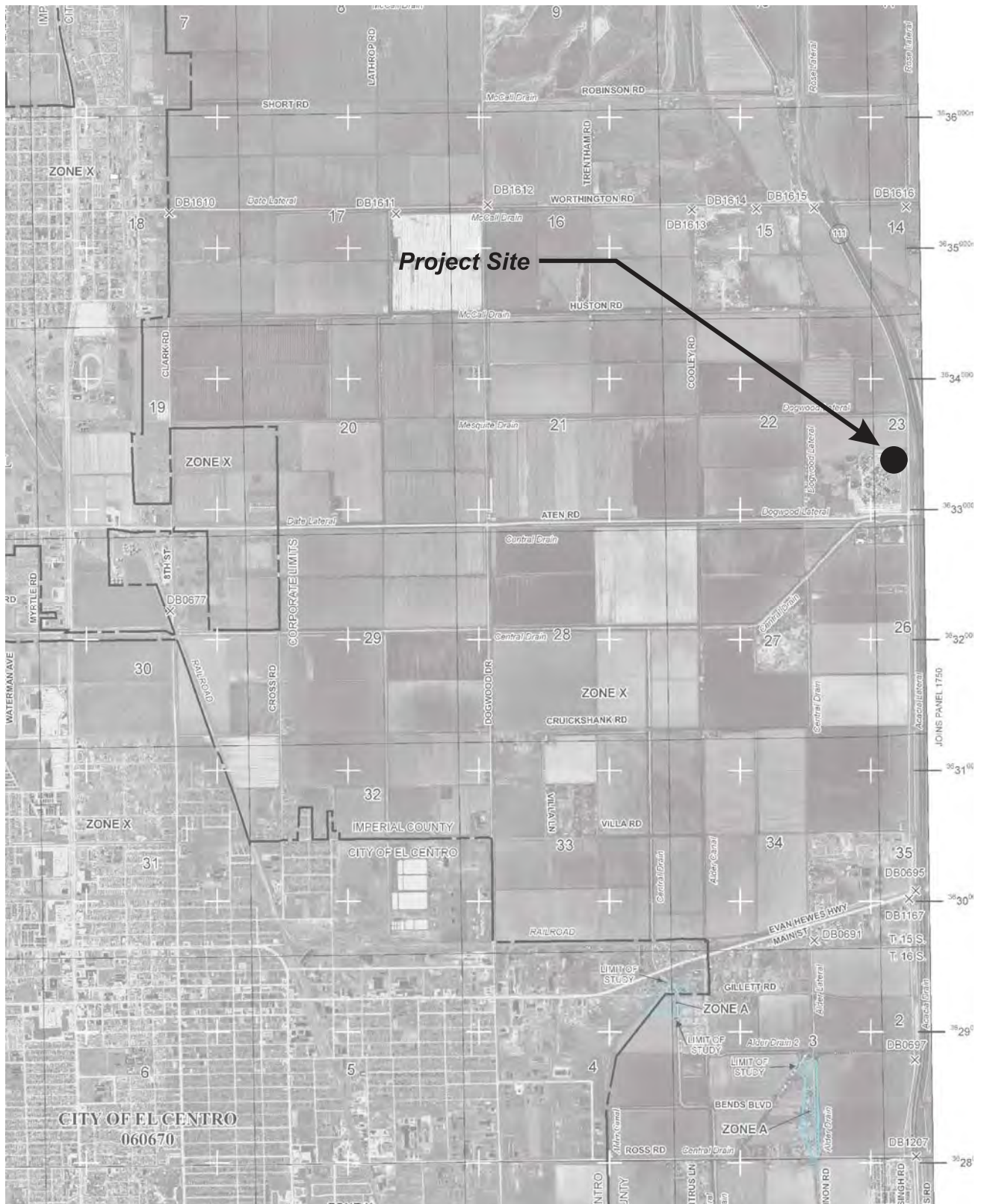


Site Location
Lat: 32.8297 N
Long: -115.5031 W

LANDMARK
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Project No.: LE20064

Earthquake Zones of
Required Investigation Map

Plate
A-8



Reference: Federal Emergency Management Agency (FEMA)
Panel Number 06025C1725C

LANDMARK

Geo-Engineers and Geologists

Project No.: LE20064

FEMA Flood Map

Plate
A-9

LEGEND



SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.



FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.



OTHER FLOOD AREAS

ZONE X

Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.



OTHER AREAS

ZONE X

Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D

Areas in which flood hazards are undetermined, but possible.



COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS



OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Base Flood Elevation line and value; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- Cross section line
- Transect line
- $87^{\circ}07'45", 32^{\circ}22'30"$ Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- $\approx 76^{00m}N$ 1000-meter Universal Transverse Mercator grid values, zone 11N
- 600000 FT 5000-foot grid ticks: California State Plane coordinate system, zone VI (FIPZONE 0406), Lambert Conformal Conic projection
- DX5510 x Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 River Mile

APPENDIX B

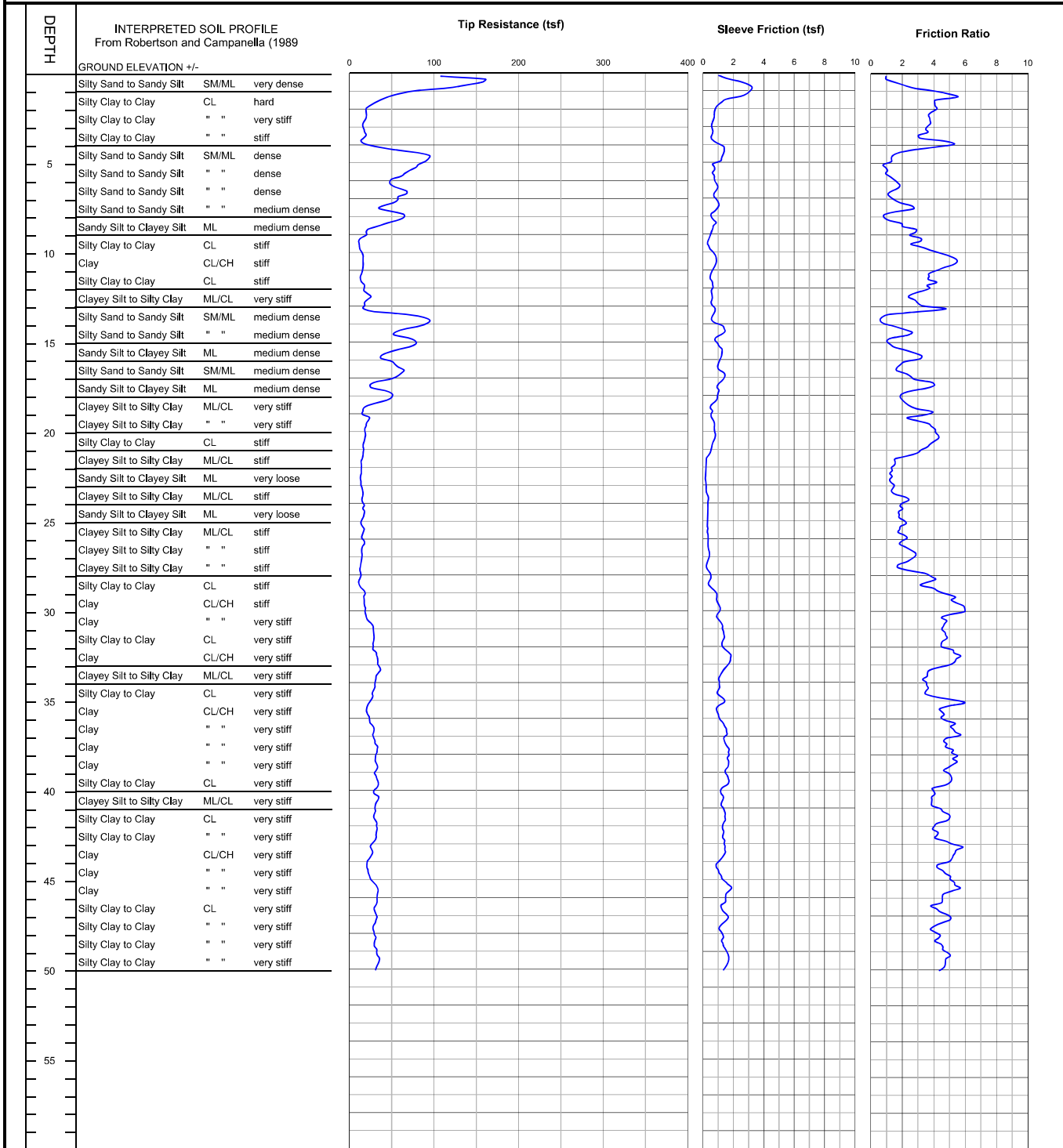
CLIENT: Imperial Community College District
PROJECT: IVS DSPS Modular Building - Imperial, CA

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric
 Cone with 23 ton reaction weight

LOCATION: See Site and Boring Location Plan

DATE: 4/27/2020

CONE SOUNDING DATA CPT-1



END OF SOUNDING AT 50 ft.

Project No.
LE20064



PLATE
B-1

LANDMARK CONSULTANTS, INC.

CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: IVS DSPS Modular Building - Imperial, CA

Project No: LE20064

Date: 4/27/2020

CONE SOUNDING: CPT-1		Phi Correlation: 0 0-Schm(78),1-R&C(83),2-PHT(74)												
Est. GWT (ft): 8														
Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	Nk: Phi (deg.)	17 Su (tsf)	OCR
0.15	0.5	142.03	1.16	Sand to Silty Sand	SP/SM	very dense	115	26	268.5	15	145	48		
0.30	1.0	110.39	3.01	Sandy Silt to Clayey Silt	ML	very dense	115	32	208.7	35	121	45		
0.45	1.5	47.11	4.87	Silty Clay to Clay	CL	hard	125	27		60			2.77	>10
0.60	2.0	24.78	4.12	Silty Clay to Clay	CL	very stiff	125	14		70			1.45	>10
0.75	2.5	19.86	3.77	Silty Clay to Clay	CL	very stiff	125	11		75			1.16	>10
0.93	3.0	16.68	3.72	Silty Clay to Clay	CL	stiff	125	10		80			0.97	>10
1.08	3.5	18.28	3.38	Clayey Silt to Silty Clay	ML/CL	very stiff	120	7		75			1.06	>10
1.23	4.0	16.10	4.41	Clay	CL/CH	stiff	125	13		90			0.93	>10
1.38	4.5	55.12	2.83	Sandy Silt to Clayey Silt	ML	dense	115	16	104.2	45	74	38		
1.53	5.0	92.58	1.33	Sand to Silty Sand	SP/SM	dense	115	17	168.0	20	88	40		
1.68	5.5	74.56	0.93	Sand to Silty Sand	SP/SM	dense	115	14	129.0	20	80	39		
1.83	6.0	53.05	1.45	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	87.9	30	69	38		
1.98	6.5	57.81	1.62	Silty Sand to Sandy Silt	SM/ML	dense	115	13	92.0	30	70	38		
2.13	7.0	60.73	1.29	Silty Sand to Sandy Silt	SM/ML	dense	115	13	93.1	25	70	38		
2.28	7.5	42.57	2.41	Sandy Silt to Clayey Silt	ML	medium dense	115	12	63.1	45	59	36		
2.45	8.0	59.64	1.08	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	85.6	25	68	38		
2.60	8.5	44.95	1.73	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	63.6	35	59	36		
2.75	9.0	20.85	2.73	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8		65			1.20	>10
2.90	9.5	12.03	2.96	Silty Clay to Clay	CL	stiff	125	7		90			0.68	>10
3.05	10.0	13.10	3.79	Silty Clay to Clay	CL	stiff	125	7		95			0.74	>10
3.20	10.5	16.13	5.29	Clay	CL/CH	stiff	125	13		100			0.92	>10
3.35	11.0	15.90	4.67	Clay	CL/CH	stiff	125	13		95			0.90	>10
3.50	11.5	13.54	3.69	Silty Clay to Clay	CL	stiff	125	8		95			0.76	>10
3.65	12.0	16.50	3.84	Silty Clay to Clay	CL	stiff	125	9		90			0.94	>10
3.80	12.5	21.41	2.75	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		70			1.22	>10
3.95	13.0	19.08	3.03	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8		80			1.09	>10
4.13	13.5	36.44	2.94	Sandy Silt to Clayey Silt	ML	medium dense	115	10	44.9	60	49	35		
4.28	14.0	91.66	0.70	Sand to Silty Sand	SP/SM	dense	115	17	111.7	15	76	39		
4.43	14.5	67.69	2.10	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	81.7	40	67	37		
4.58	15.0	66.41	1.53	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	79.3	35	66	37		
4.73	15.5	69.34	1.63	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	82.0	35	67	37		
4.88	16.0	42.59	2.82	Sandy Silt to Clayey Silt	ML	medium dense	115	12	49.9	55	52	35		
5.03	16.5	58.79	1.73	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	68.2	40	61	37		
5.18	17.0	55.59	2.52	Sandy Silt to Clayey Silt	ML	medium dense	115	16	63.9	50	59	36		
5.33	17.5	27.11	3.82	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11		80			1.55	>10
5.48	18.0	47.79	2.10	Sandy Silt to Clayey Silt	ML	medium dense	115	14	53.9	50	54	36		
5.65	18.5	34.07	2.23	Sandy Silt to Clayey Silt	ML	medium dense	115	10	38.1	60	44	34		
5.80	19.0	15.92	3.46	Silty Clay to Clay	CL	stiff	125	9		100			0.89	>10
5.95	19.5	22.06	2.96	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		85			1.25	>10
6.10	20.0	18.69	4.02	Silty Clay to Clay	CL	very stiff	125	11		100			1.05	>10
6.25	20.5	18.33	4.21	Silty Clay to Clay	CL	very stiff	125	10		100			1.03	>10
6.40	21.0	16.50	3.52	Silty Clay to Clay	CL	stiff	125	9		100			0.92	>10
6.55	21.5	15.85	2.29	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		95			0.88	>10
6.70	22.0	14.01	1.46	Sandy Silt to Clayey Silt	ML	very loose	115	4	14.7	85	16	30		
6.85	22.5	13.68	1.31	Sandy Silt to Clayey Silt	ML	very loose	115	4	14.2	85	15	30		
7.00	23.0	13.43	1.32	Sandy Silt to Clayey Silt	ML	very loose	115	4	13.9	90	14	30		
7.18	23.5	15.47	1.41	Sandy Silt to Clayey Silt	ML	very loose	115	4	15.9	85	18	31		
7.33	24.0	15.29	2.21	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		95			0.85	>10
7.48	24.5	17.10	1.88	Clayey Silt to Silty Clay	ML/CL	stiff	120	7		90			0.95	>10
7.63	25.0	16.04	1.91	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		90			0.89	>10
7.78	25.5	15.35	1.99	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		95			0.85	9.39
7.93	26.0	15.36	2.06	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		100			0.85	9.19
8.08	26.5	16.24	2.13	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		95			0.90	>10
8.23	27.0	14.74	2.76	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		100			0.81	8.00
8.38	27.5	13.39	1.92	Clayey Silt to Silty Clay	ML/CL	stiff	120	5		100			0.73	6.54
8.53	28.0	13.04	3.25	Silty Clay to Clay	CL	stiff	125	7		100			0.71	4.47
8.68	28.5	11.59	3.62	Silty Clay to Clay	CL	stiff	125	7		100			0.62	3.66
8.85	29.0	16.50	4.35	Clay	CL/CH	stiff	125	13		100			0.91	4.89
9.00	29.5	17.29	5.32	Clay	CL/CH	stiff	125	14		100			0.95	5.21
9.15	30.0	18.40	5.94	Clay	CL/CH	very stiff	125	15		100			1.02	5.53
9.30	30.5	20.22	4.77	Clay	CL/CH	very stiff	125	16		100			1.12	6.32
9.45	31.0	27.10	4.61	Silty Clay to Clay	CL	very stiff	125	15		100			1.53	>10
9.60	31.5	28.84	4.78	Clay	CL/CH	very stiff	125	23		100			1.63	>10
9.75	32.0	28.22	4.53	Silty Clay to Clay	CL	very stiff	125	16		100			1.59	>10
9.90	32.5	30.49	5.41	Clay	CL/CH	very stiff	125	24		100			1.72	>10
10.05	33.0	33.38	5.28	Clay	CL/CH	very stiff	125	27		100			1.89	>10
10.20	33.5	35.50	3.85	Clayey Silt to Silty Clay	ML/CL	hard	120	14		90			2.02	>10
10.38	34.0	31.08	3.47	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12		90			1.76	>10
10.53	34.5	29.45	3.57	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12		95			1.66	>10
10.68	35.0	26.91	4.31	Silty Clay to Clay	CL	very stiff	125	15		100			1.51	>10
10.83	35.5	21.77	5.13	Clay	CL/CH	very stiff	125	17		100			1.21	5.76
10.98	36.0	21.65	4.55	Clay	CL/CH	very stiff	125	17		100			1.20	5.65
11.13	36.5	26.26	5.12	Clay	CL/CH	very stiff	125	21		100			1.47	7.56
11.28	37.0	28.30	5.31	Clay	CL/CH	very stiff	125	23		100			1.59	8.56
11.43	37.5	31.22	4.75	Silty Clay to Clay	CL	very stiff	125	18		100			1.76	>10
11.58	38.0	32.10	5.30	Clay	CL/CH	very stiff	125	26		100			1.81	>10
11.73	38.5	31.17	5.31	Clay	CL/CH	very stiff	125	25		100			1.75	9.79

LANDMARK CONSULTANTS, INC.

CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: IVS DSPS Modular Building - Imperial, CA

Project No: LE20064

Date: 4/27/2020

CONE SOUNDING: CPT-1				Phi Correlation: 0 0-Schm(78),1-R&C(83),2-PHT(74)											
Est. GWT (ft): 8															
Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	Nk: Phi (deg.)	17 Su (tsf)	OCR	
11.88	39.0	31.63	4.84	Silty Clay to Clay	CL	very stiff	125	18		100			1.78	>10	
12.05	39.5	32.52	5.10	Clay	CL/CH	very stiff	125	26		100			1.83	>10	
12.20	40.0	31.91	4.21	Silty Clay to Clay	CL	very stiff	125	18		100			1.79	>10	
12.35	40.5	32.50	3.95	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		100			1.83	>10	
12.50	41.0	30.86	4.07	Silty Clay to Clay	CL	very stiff	125	18		100			1.73	>10	
12.65	41.5	29.60	4.86	Clay	CL/CH	very stiff	125	24		100			1.66	7.70	
12.80	42.0	31.57	4.36	Silty Clay to Clay	CL	very stiff	125	18		100			1.77	>10	
12.95	42.5	32.07	4.14	Silty Clay to Clay	CL	very stiff	125	18		100			1.80	>10	
13.10	43.0	29.47	4.68	Silty Clay to Clay	CL	very stiff	125	17		100			1.65	9.79	
13.25	43.5	26.11	5.56	Clay	CL/CH	very stiff	125	21		100			1.45	5.88	
13.40	44.0	23.75	5.12	Clay	CL/CH	very stiff	125	19		100			1.31	4.89	
13.58	44.5	21.06	4.35	Silty Clay to Clay	CL	very stiff	125	12		100			1.15	5.10	
13.73	45.0	23.57	4.95	Clay	CL/CH	very stiff	125	19		100			1.30	4.68	
13.88	45.5	30.59	5.46	Clay	CL/CH	very stiff	125	24		100			1.71	7.00	
14.03	46.0	33.26	4.77	Silty Clay to Clay	CL	very stiff	125	19		100			1.86	>10	
14.18	46.5	32.15	4.28	Silty Clay to Clay	CL	very stiff	125	18		100			1.80	>10	
14.33	47.0	30.77	4.63	Silty Clay to Clay	CL	very stiff	125	18		100			1.71	9.00	
14.48	47.5	30.08	4.47	Silty Clay to Clay	CL	very stiff	125	17		100			1.67	8.56	
14.63	48.0	28.74	4.10	Silty Clay to Clay	CL	very stiff	125	16		100			1.59	7.70	
14.78	48.5	30.23	4.27	Silty Clay to Clay	CL	very stiff	125	17		100			1.68	8.27	
14.93	49.0	31.35	4.69	Silty Clay to Clay	CL	very stiff	125	18		100			1.75	8.70	
15.10	49.5	34.53	4.86	Clay	CL/CH	very stiff	125	28		100			1.93	7.70	
15.25	50.0	32.28	4.58	Silty Clay to Clay	CL	very stiff	125	18		100			1.80	8.85	

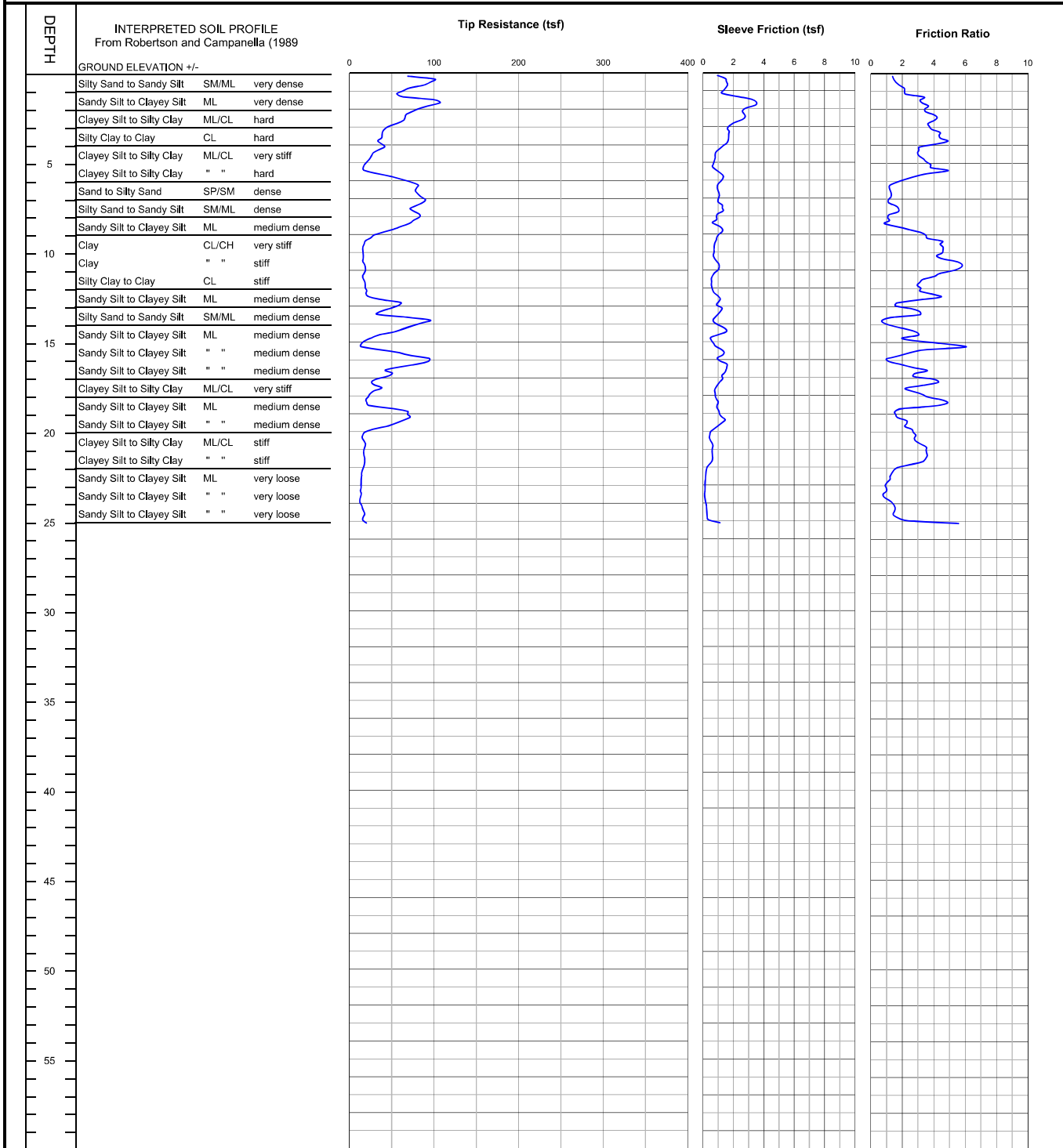
CLIENT: Imperial Community College District
PROJECT: IVS DSPS Modular Building - Imperial, CA

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric
 Cone with 23 ton reaction weight

LOCATION: See Site and Boring Location Plan

DATE: 4/27/2020

CONE SOUNDING DATA CPT-2



END OF SOUNDING AT 25 ft.

Project No.
LE20064



PLATE
B-2

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: IVS DSPS Modular Building - Imperial, CA

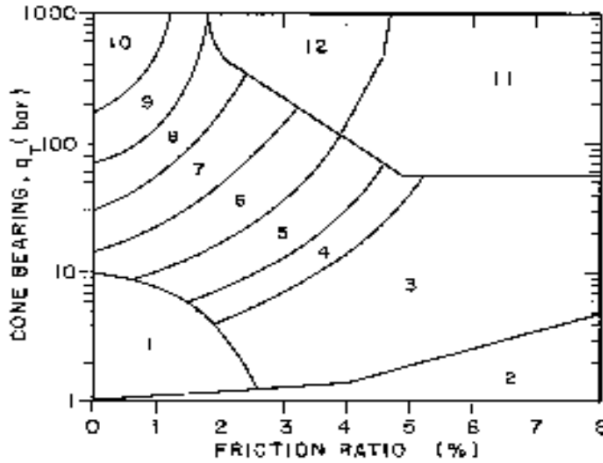
Project No: LE20064

Date: 4/27/2020

CONE SOUNDING: CPT-2		Phi Correlation: 0 0-Schm(78),1-R&C(83),2-PHT(74)												
Est. GWT (ft): 8														
Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	Nk: Phi (deg.)	17 Su (tsf)	OCR
0.15	0.5	88.64	1.48	Silty Sand to Sandy Silt	SM/ML	very dense	115	20	167.6	20	131	46		
0.30	1.0	74.30	2.04	Silty Sand to Sandy Silt	SM/ML	very dense	115	17	140.5	30	109	43		
0.45	1.5	73.05	2.91	Sandy Silt to Clayey Silt	ML	very dense	115	21	138.1	40	101	42		
0.60	2.0	94.81	3.46	Sandy Silt to Clayey Silt	ML	very dense	115	27	179.2	40	104	43		
0.75	2.5	69.14	3.91	Clayey Silt to Silty Clay	ML/CL	hard	120	28		45			4.06	>10
0.93	3.0	55.94	3.79	Clayey Silt to Silty Clay	ML/CL	hard	120	22		50			3.28	>10
1.08	3.5	39.73	4.21	Silty Clay to Clay	CL	hard	125	23		60			2.33	>10
1.23	4.0	36.44	4.49	Silty Clay to Clay	CL	hard	125	21		65			2.13	>10
1.38	4.5	35.03	3.04	Clayey Silt to Silty Clay	ML/CL	hard	120	14		55			2.05	>10
1.53	5.0	23.75	3.31	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		65			1.38	>10
1.68	5.5	20.47	4.05	Silty Clay to Clay	CL	very stiff	125	12		75			1.19	>10
1.83	6.0	60.28	2.17	Sandy Silt to Clayey Silt	ML	dense	115	17	100.0	35	72	38		
1.98	6.5	79.50	1.21	Sand to Silty Sand	SP/SM	dense	115	14	126.7	20	79	39		
2.13	7.0	85.01	1.23	Sand to Silty Sand	SP/SM	dense	115	15	130.6	20	80	39		
2.28	7.5	79.17	1.51	Silty Sand to Sandy Silt	SM/ML	dense	115	18	117.5	25	77	39		
2.45	8.0	80.72	1.32	Sand to Silty Sand	SP/SM	dense	115	15	115.9	20	77	39		
2.60	8.5	69.85	1.22	Silty Sand to Sandy Silt	SM/ML	dense	115	16	98.9	25	72	38		
2.75	9.0	40.88	3.01	Sandy Silt to Clayey Silt	ML	medium dense	115	12	57.1	50	56	36		
2.90	9.5	20.55	4.19	Silty Clay to Clay	CL	very stiff	125	12		80			1.18	>10
3.05	10.0	15.96	4.58	Clay	CL/CH	stiff	125	13		90			0.91	>10
3.20	10.5	16.11	4.75	Clay	CL/CH	stiff	125	13		95			0.92	>10
3.35	11.0	18.50	5.60	Clay	CL/CH	very stiff	125	15		95			1.06	>10
3.50	11.5	16.53	3.91	Silty Clay to Clay	CL	stiff	125	9		90			0.94	>10
3.65	12.0	18.51	3.08	Clayey Silt to Silty Clay	ML/CL	very stiff	120	7		80			1.05	>10
3.80	12.5	20.89	3.84	Silty Clay to Clay	CL	very stiff	125	12		80			1.19	>10
3.95	13.0	52.11	2.08	Sandy Silt to Clayey Silt	ML	medium dense	115	15	65.1	40	60	36		
4.13	13.5	39.11	2.95	Sandy Silt to Clayey Silt	ML	medium dense	115	11	48.3	55	51	35		
4.28	14.0	82.79	0.93	Sand to Silty Sand	SP/SM	dense	115	15	101.2	20	73	38		
4.43	14.5	62.94	2.25	Sandy Silt to Clayey Silt	ML	medium dense	115	18	76.2	40	64	37		
4.58	15.0	26.44	2.67	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11		70			1.52	>10
4.73	15.5	21.06	4.74	Clay	CL/CH	very stiff	125	17		95			1.20	>10
4.88	16.0	79.44	1.59	Silty Sand to Sandy Silt	SM/ML	dense	115	18	93.1	30	70	38		
5.03	16.5	59.63	2.76	Sandy Silt to Clayey Silt	ML	medium dense	115	17	69.2	50	62	37		
5.18	17.0	42.81	3.18	Clayey Silt to Silty Clay	ML/CL	hard	120	17		60			2.48	>10
5.33	17.5	31.28	3.28	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		70			1.80	>10
5.48	18.0	25.41	3.17	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		80			1.45	>10
5.65	18.5	20.93	4.51	Clay	CL/CH	very stiff	125	17		95			1.19	>10
5.80	19.0	62.38	1.66	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	68.9	40	62	37		
5.95	19.5	63.69	2.09	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	69.8	45	62	37		
6.10	20.0	31.10	2.49	Sandy Silt to Clayey Silt	ML	medium dense	115	9	33.8	65	40	34		
6.25	20.5	16.00	2.83	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		95			0.89	>10
6.40	21.0	18.18	3.41	Clayey Silt to Silty Clay	ML/CL	very stiff	120	7		95			1.02	>10
6.55	21.5	17.34	3.54	Silty Clay to Clay	CL	stiff	125	10		100			0.97	>10
6.70	22.0	17.46	2.49	Clayey Silt to Silty Clay	ML/CL	stiff	120	7		90			0.98	>10
6.85	22.5	14.69	1.33	Sandy Silt to Clayey Silt	ML	very loose	115	4	15.3	85	17	30		
7.00	23.0	13.73	1.06	Sandy Silt to Clayey Silt	ML	very loose	115	4	14.2	80	15	30		
7.18	23.5	13.61	0.92	Sandy Silt to Clayey Silt	ML	very loose	115	4	14.0	80	14	30		
7.33	24.0	12.68	1.11	Sandy Silt to Clayey Silt	ML	very loose	115	4	12.9	90	12	30		
7.48	24.5	15.56	1.51	Sandy Silt to Clayey Silt	ML	very loose	115	4	15.7	85	18	31		
7.63	25.0	16.68	1.79	Sandy Silt to Clayey Silt	ML	very loose	115	5	16.7	90	20	31		

Simplified Soil Classification Chart

After Robertson & Campanella (1989)



Geotechnical Parameters from CPT Data:

Equivalent SPT N(60) blow count = $Q_c / (Q_c/N \text{ Ratio})$

$N1(60) = C_n * N(60)$ Normalized SPT blow count

$C_n = 1 / (p'o)^{0.5} < 1.6$ max. from Liao & Whitman (1986)

$p'o$ = effective overburden pressure (tsf) using unit densities given below and estimated groundwater table.

Dr = Relative density (%) from Jamiolkowski et. al. (1986) relationship = $-98 + 68 * \log(Q_c / p'o^{0.5})$ where $Q_c, p'o$ in tonne/sqm

Note: 1 tonne/sqm = 0.1024 tsf, 1 bar = 1.0443 tsf

Φ = Friction Angle estimated from either:

1. Robertson & Campanella (1983) chart:

$$\Phi = 5.3 + 24 * (\log(Q_c / p'o)) + 3 * (\log(Q_c / p'o))^2$$

2. Peck, Hansen & Thornburn (1974) N-Phi Correlation

3. Schmertman (1978) chart [$\Phi = 28 + 0.14 * Dr$ for fine uniform sands]

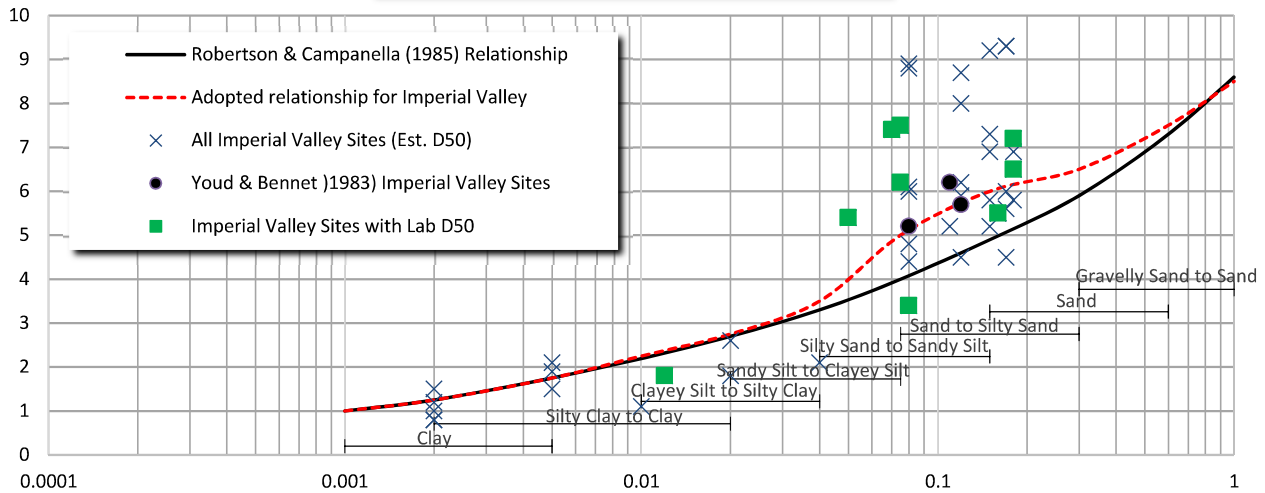
S_u = undrained shear strength (tsf)

$$= (Q_c - p'o) / N_k \text{ where } N_k \text{ varies from 10 to 22, 17 for OC clays}$$

OCR = Overconsolidation Ratio estimated from Schmertman (1978)

chart using $S_u / p'o$ ratio and estimated normal consolidated $S_u / p'o$

Variation of Q_c/N Ratio with Grain Size



Note: Assumed Properties and Adopted Q_c/N Ratio based on correlations from Imperial Valley, California soils

Table of Soil Types and Assumed Properties

Zone	Soil Classification	UCS	Density (pcf)	R&C Q_c/N	Adopted Q_c/N	Est. PI	Fines (%)	D50 (mm)
1	Sensitive fine grained	ML	120	2	2	NP-15	65-100	0.02
2	Organic Material	OL/OH	120	1	1	--	--	--
3	Clay	CL/CH	125	1	1.25	25-40+	90-100	0.002
4	Silty Clay to Clay	CL	125	1.5	2	15-40	90-100	0.01
5	Clayey Silt to Silty Clay	ML/CL	120	2	2.75	25-May	90-100	0.02
6	Sandy Silt to Clayey Silt	ML	115	2.5	3.5	NP-10	65-100	0.04
7	Silty Sand to Silty Silt	SM/ML	115	3	5	NP	35-75	0.075
8	Sand to Silty Sand	SP/SM	115	4	6	NP	May-35	0.15
9	Sand	SP	110	5	6.5	NP	0-5	0.3
10	Gravelly Sand to Sand	SW	115	6	7.5	NP	0-5	0.6
11	Overconsolidated Soil	--	120	1	1	NP	90-100	0.01
12	Sand to Clayey Sand	SP/SC	115	2	2	NP-5	--	--

S_u (tsf)	Consistency
0-0.13	very soft
0.13-.25	soft
0.25-0.5	firm
0.5-1.0	stiff
1.0-2.0	very stiff
>2.0	hard

Dr (%)	Relative Density
0-15	very loose
15-35	loose
35-65	medium dense
65-85	dense
>85	very dense



Project No: LE20064

Key to CPT Interpretation of Logs

Plate B-3

APPENDIX C

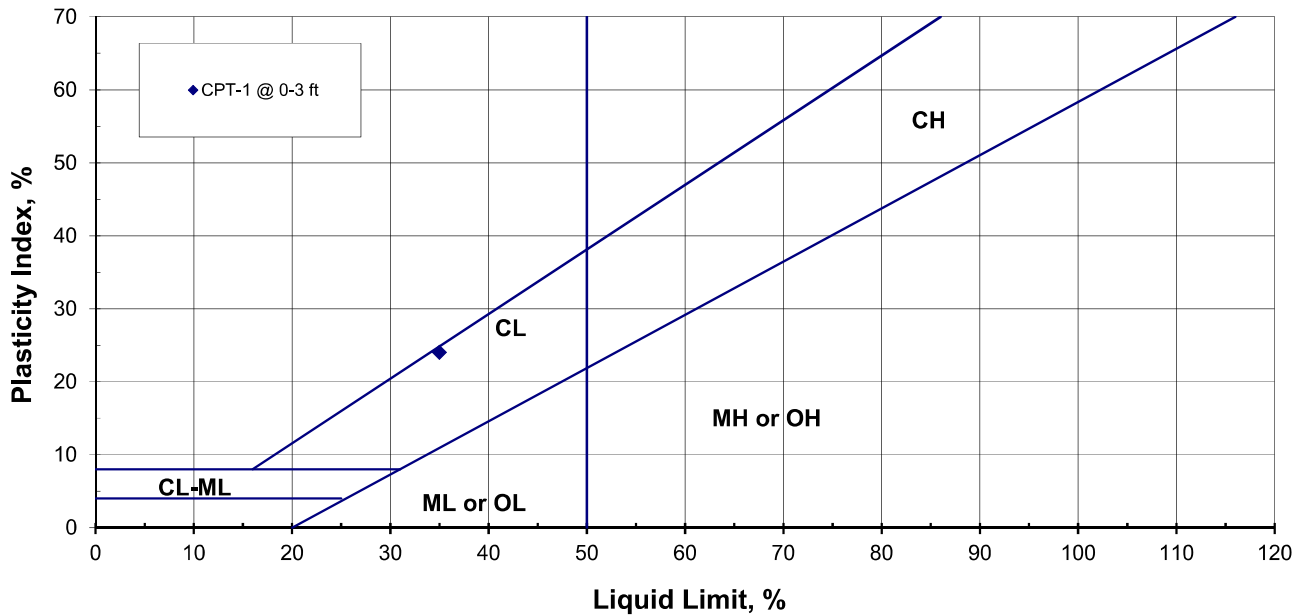
LANDMARK CONSULTANTS, INC.

CLIENT: Imperial Community College District
PROJECT: DSPTS Modular Building - Imperial, CA
JOB No.: LE20064
DATE: 05/05/20

ATTERBERG LIMITS (ASTM D4318)

Sample Location	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Classification
CPT-1	0-3	35	11	24	CL

PLASTICITY CHART

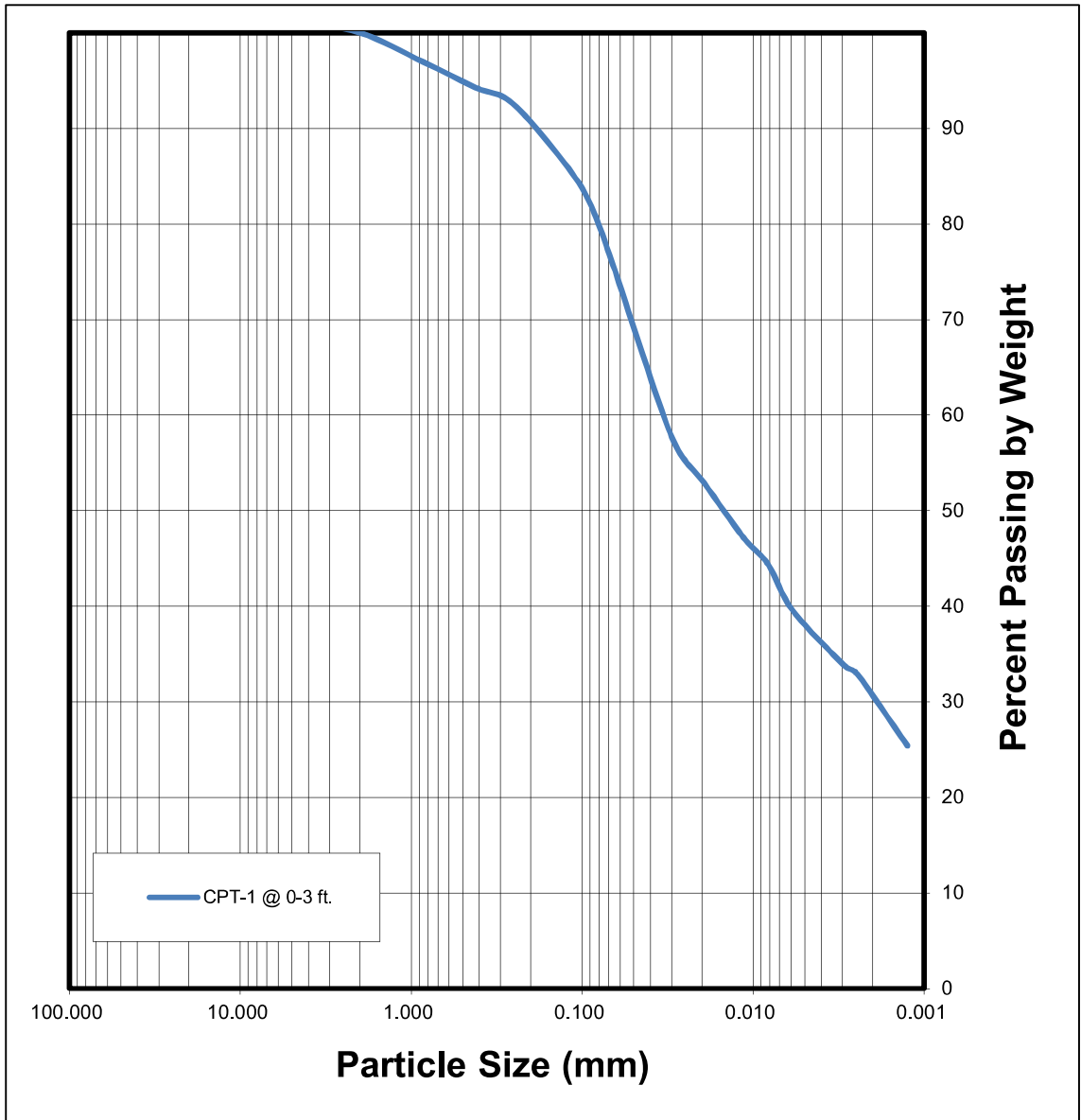


Project No.: LE20064

Atterberg Limits
Test Results

Plate
C-1

SIEVE ANALYSIS					HYDROMETER ANALYSIS
Gravel		Sand			Silt and Clay Fraction
Coarse	Fine	Coarse	Medium	Fine	



LANDMARK
Geo-Engineers and Geologists

Project No.: LE20064

Grain Size Analysis

Plate
C-2

LANDMARK CONSULTANTS, INC.

CLIENT: Imperial Community College District
PROJECT: DSPS Modular Building - Imperial, CA
JOB No.: LE20064
DATE: 05/05/20

CHEMICAL ANALYSIS

	Boring: Sample Depth, ft:	CPT-1 0-3	Caltrans Method
	pH:	8.6	643
Electrical Conductivity (mmhos):		0.9	424
Resistivity (ohm-cm):		470	643
Chloride (Cl), ppm:		180	422
Sulfate (SO₄), ppm:		979	417

General Guidelines for Soil Corrosivity

Material Affected	Chemical Agent	Range of Values	Degree of Corrosivity
Concrete	Soluble Sulfates (ppm)	0 - 1,000	Low
		1,000 - 2,000	Moderate
		2,000 - 20,000	Severe
		> 20,000	Very Severe
Normal Grade Steel	Soluble Chlorides (ppm)	0 - 200	Low
		200 - 700	Moderate
		700 - 1,500	Severe
		> 1,500	Very Severe
Normal Grade Steel	Resistivity (ohm-cm)	1 - 1,000	Very Severe
		1,000 - 2,000	Severe
		2,000 - 10,000	Moderate
		> 10,000	Low



Project No.: LE20064

**Selected Chemical
Test Results**

**Plate
C-3**

APPENDIX D

LIQUEFACTION ANALYSIS REPORT

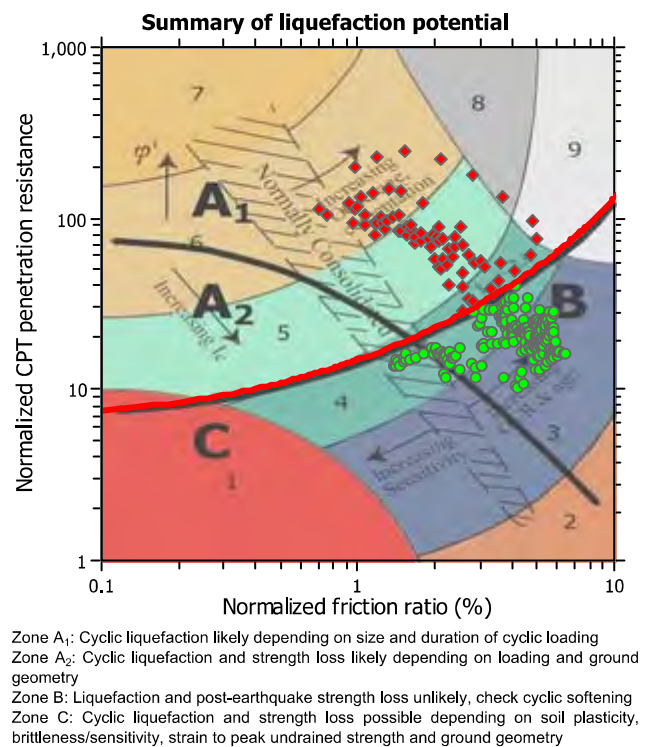
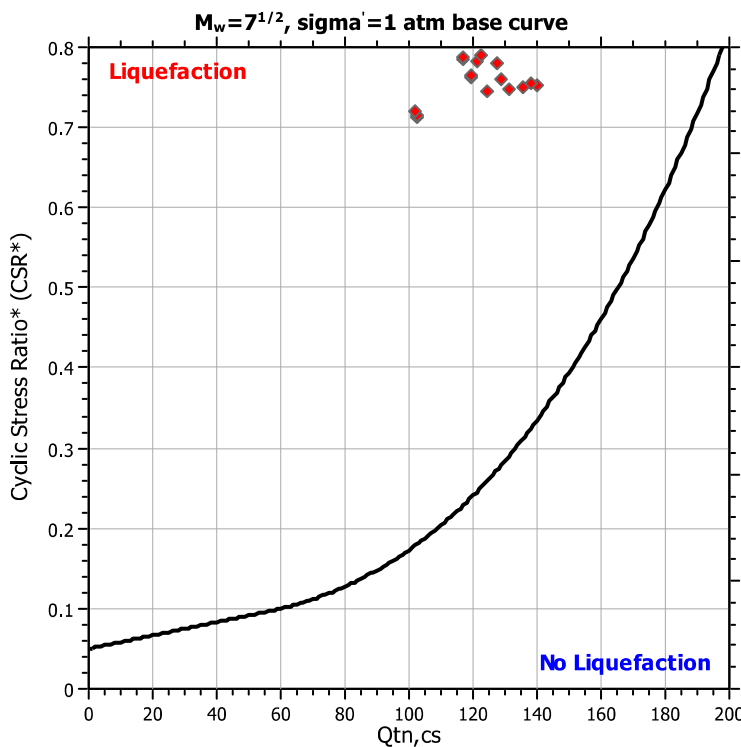
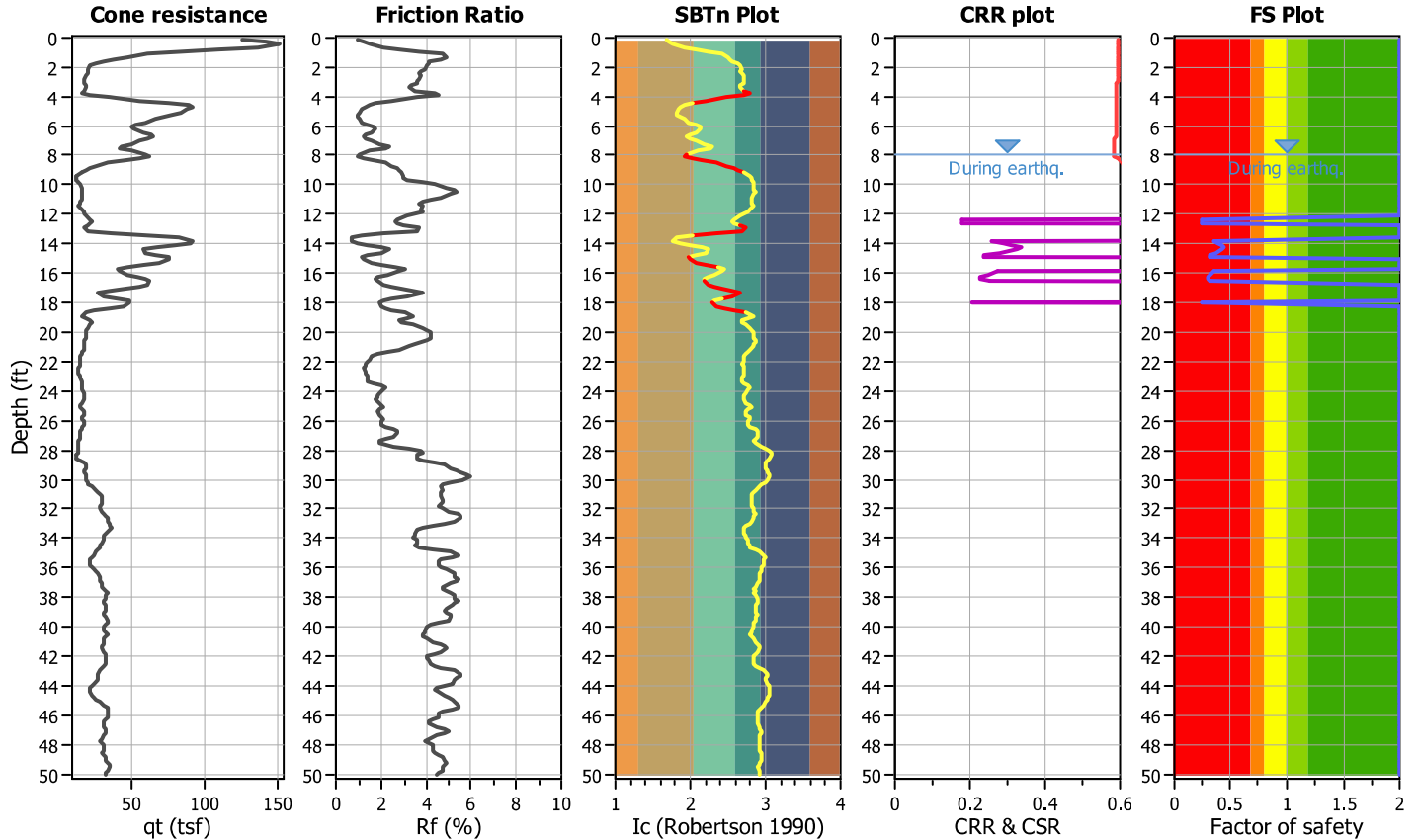
Project title : IVC DSPS Modular Building

Location : Imperial, CA

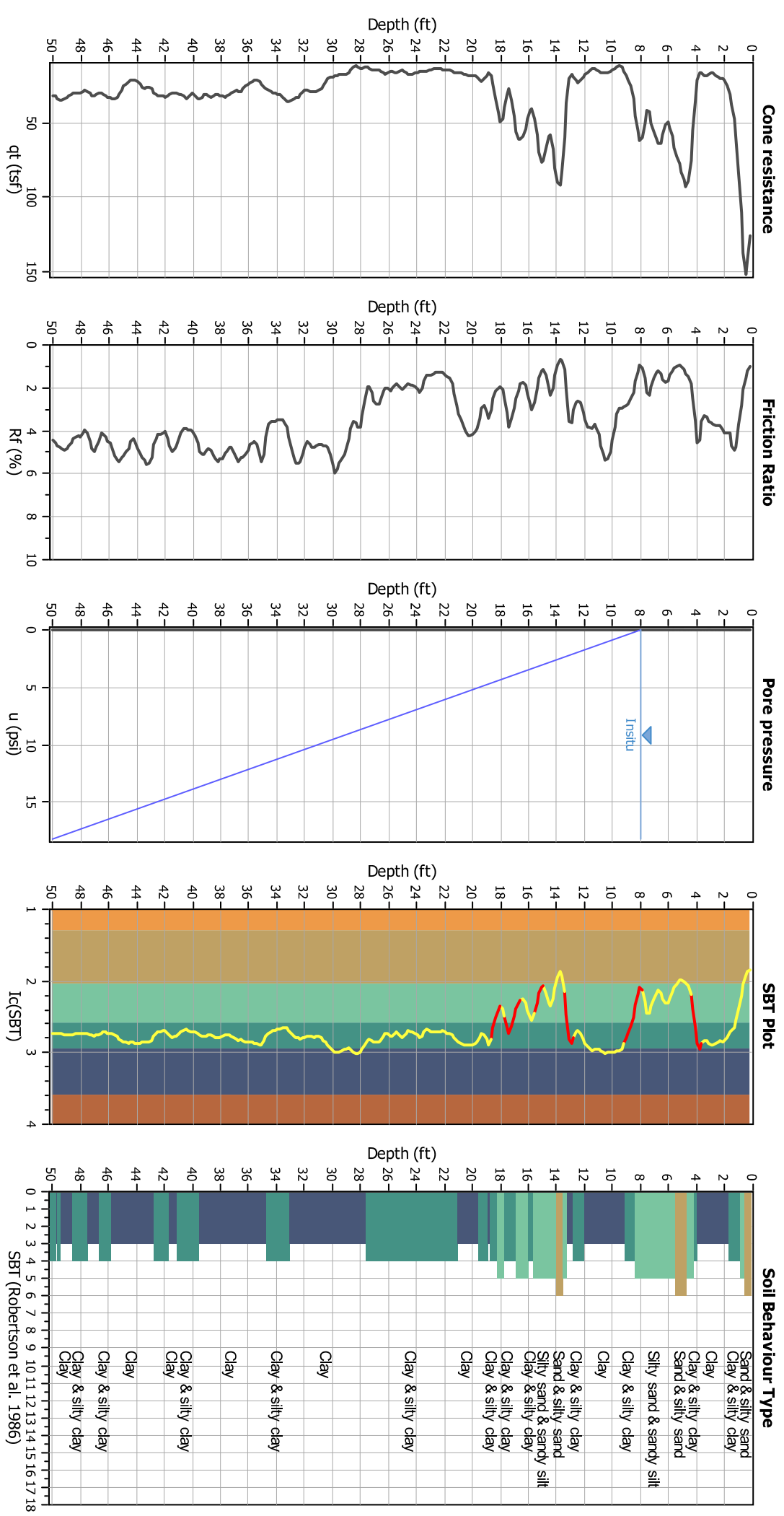
CPT file : CPT-01

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	8.00 ft	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	8.00 ft	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	7.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	N/A
Peak ground acceleration:	0.84	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based



CPT basic interpretation plots



Input parameters and analysis data

Analysis method: NCEER (1998)
 Finest correction method: NCEER (1998)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 7.00
 Peak ground acceleration: 0.84
 Depth to water table (instu): 8.00 ft

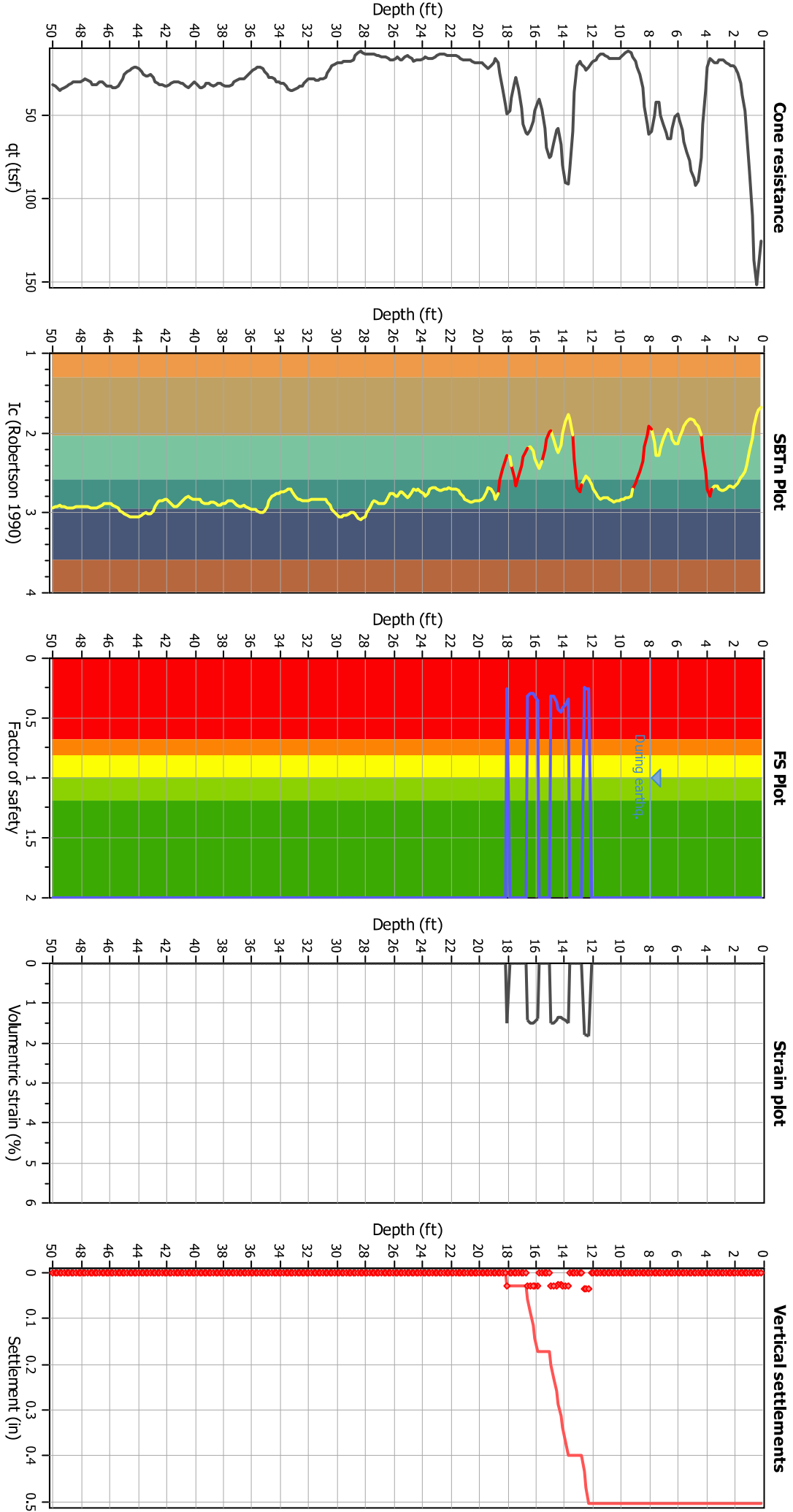
Depth to water table (earthq.): 8.00 ft
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect: applied: Yes
 K_2 applied: Yes
 Clay like behavior: applied: Sands only
 Limit depth applied: No
 Limit depth: N/A

SBT legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
- 4. Clayey silt to silty
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to
- 9. Very stiff fine grained

Estimation of post-earthquake settlements



Abbreviations

- qt: Total cone resistance (cone resistance q_c corrected for pore water effects)
- I_c: Soil Behaviour Type Index
- FS: Calculated Factor of Safety against liquefaction
- Volumetric strain: Post-liquefaction volumetric strain

:: Post-earthquake settlement due to soil liquefaction ::											
Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
8.04	113.52	2.00	0.00	0.86	0.00	8.20	115.10	2.00	0.00	0.86	0.00
8.37	113.67	2.00	0.00	0.86	0.00	8.53	111.66	2.00	0.00	0.86	0.00
8.69	106.04	2.00	0.00	0.85	0.00	8.86	103.00	2.00	0.00	0.85	0.00
9.02	97.98	2.00	0.00	0.85	0.00	9.19	92.60	2.00	0.00	0.84	0.00
9.35	86.94	2.00	0.00	0.84	0.00	9.51	85.42	2.00	0.00	0.84	0.00
9.68	89.83	2.00	0.00	0.84	0.00	9.84	101.88	2.00	0.00	0.83	0.00
10.01	114.27	2.00	0.00	0.83	0.00	10.17	124.98	2.00	0.00	0.83	0.00
10.33	130.99	2.00	0.00	0.82	0.00	10.50	132.17	2.00	0.00	0.82	0.00
10.66	128.94	2.00	0.00	0.82	0.00	10.83	122.25	2.00	0.00	0.82	0.00
10.99	113.59	2.00	0.00	0.81	0.00	11.15	106.11	2.00	0.00	0.81	0.00
11.32	101.29	2.00	0.00	0.81	0.00	11.48	103.29	2.00	0.00	0.81	0.00
11.65	107.13	2.00	0.00	0.80	0.00	11.81	111.72	2.00	0.00	0.80	0.00
11.98	109.63	2.00	0.00	0.80	0.00	12.14	106.51	2.00	0.00	0.79	0.00
12.30	102.23	0.25	1.82	0.79	0.04	12.47	102.21	0.25	1.81	0.79	0.04
12.63	101.92	0.25	1.81	0.79	0.04	12.80	103.55	2.00	0.00	0.78	0.00
12.96	110.78	2.00	0.00	0.78	0.00	13.12	115.43	2.00	0.00	0.78	0.00
13.29	107.23	2.00	0.00	0.77	0.00	13.45	106.68	2.00	0.00	0.77	0.00
13.62	117.47	2.00	0.00	0.77	0.00	13.78	124.15	0.35	1.50	0.77	0.03
13.94	131.33	0.39	1.43	0.76	0.03	14.11	135.32	0.41	1.39	0.76	0.03
14.27	140.23	0.45	1.34	0.76	0.03	14.44	138.01	0.43	1.36	0.76	0.03
14.60	128.52	0.37	1.43	0.75	0.03	14.76	119.40	0.31	1.51	0.75	0.03
14.93	119.50	0.31	1.51	0.75	0.03	15.09	122.38	2.00	0.00	0.74	0.00
15.26	125.66	2.00	0.00	0.74	0.00	15.42	127.63	2.00	0.00	0.74	0.00
15.58	131.62	2.00	0.00	0.74	0.00	15.75	132.33	2.00	0.00	0.73	0.00
15.91	127.54	0.35	1.40	0.73	0.03	16.08	121.33	0.31	1.45	0.73	0.03
16.24	116.73	0.29	1.49	0.72	0.03	16.40	116.85	0.29	1.48	0.72	0.03
16.57	122.79	0.32	1.42	0.72	0.03	16.73	130.23	2.00	0.00	0.72	0.00
16.90	135.09	2.00	0.00	0.71	0.00	17.06	134.38	2.00	0.00	0.71	0.00
17.22	130.50	2.00	0.00	0.71	0.00	17.39	126.04	2.00	0.00	0.71	0.00
17.55	119.77	2.00	0.00	0.70	0.00	17.72	115.08	2.00	0.00	0.70	0.00
17.88	113.25	2.00	0.00	0.70	0.00	18.04	110.50	0.25	1.49	0.69	0.03
18.21	106.50	2.00	0.00	0.69	0.00	18.37	100.18	2.00	0.00	0.69	0.00
18.54	93.93	2.00	0.00	0.69	0.00	18.70	94.21	2.00	0.00	0.68	0.00
18.86	95.43	2.00	0.00	0.68	0.00	19.03	95.31	2.00	0.00	0.68	0.00
19.19	94.47	2.00	0.00	0.67	0.00	19.36	98.70	2.00	0.00	0.67	0.00
19.52	104.93	2.00	0.00	0.67	0.00	19.69	107.86	2.00	0.00	0.67	0.00
19.85	108.46	2.00	0.00	0.66	0.00	20.01	109.77	2.00	0.00	0.66	0.00
20.18	110.69	2.00	0.00	0.66	0.00	20.34	109.60	2.00	0.00	0.66	0.00
20.51	105.12	2.00	0.00	0.65	0.00	20.67	100.09	2.00	0.00	0.65	0.00
20.83	95.40	2.00	0.00	0.65	0.00	21.00	91.49	2.00	0.00	0.64	0.00
21.16	85.50	2.00	0.00	0.64	0.00	21.33	76.33	2.00	0.00	0.64	0.00
21.49	67.46	2.00	0.00	0.64	0.00	21.65	61.49	2.00	0.00	0.63	0.00
21.82	59.64	2.00	0.00	0.63	0.00	21.98	58.57	2.00	0.00	0.63	0.00
22.15	56.69	2.00	0.00	0.62	0.00	22.31	56.37	2.00	0.00	0.62	0.00
22.47	54.97	2.00	0.00	0.62	0.00	22.64	55.19	2.00	0.00	0.62	0.00
22.80	56.22	2.00	0.00	0.61	0.00	22.97	58.03	2.00	0.00	0.61	0.00
23.13	58.86	2.00	0.00	0.61	0.00	23.29	60.02	2.00	0.00	0.61	0.00
23.46	64.77	2.00	0.00	0.60	0.00	23.62	70.14	2.00	0.00	0.60	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)											
Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
23.79	72.54	2.00	0.00	0.60	0.00	23.95	71.77	2.00	0.00	0.59	0.00
24.11	70.30	2.00	0.00	0.59	0.00	24.28	69.78	2.00	0.00	0.59	0.00
24.44	69.21	2.00	0.00	0.59	0.00	24.61	68.26	2.00	0.00	0.58	0.00
24.77	68.38	2.00	0.00	0.58	0.00	24.93	68.64	2.00	0.00	0.58	0.00
25.10	68.35	2.00	0.00	0.57	0.00	25.26	68.27	2.00	0.00	0.57	0.00
25.43	67.07	2.00	0.00	0.57	0.00	25.59	68.29	2.00	0.00	0.57	0.00
25.75	69.12	2.00	0.00	0.56	0.00	25.92	70.61	2.00	0.00	0.56	0.00
26.08	70.17	2.00	0.00	0.56	0.00	26.25	70.13	2.00	0.00	0.56	0.00
26.41	71.41	2.00	0.00	0.55	0.00	26.57	74.43	2.00	0.00	0.55	0.00
26.74	76.82	2.00	0.00	0.55	0.00	26.90	76.98	2.00	0.00	0.54	0.00
27.07	74.15	2.00	0.00	0.54	0.00	27.23	68.46	2.00	0.00	0.54	0.00
27.40	63.37	2.00	0.00	0.54	0.00	27.56	62.89	2.00	0.00	0.53	0.00
27.72	69.95	2.00	0.00	0.53	0.00	27.89	78.18	2.00	0.00	0.53	0.00
28.05	83.09	2.00	0.00	0.52	0.00	28.22	81.21	2.00	0.00	0.52	0.00
28.38	77.13	2.00	0.00	0.52	0.00	28.54	78.09	2.00	0.00	0.52	0.00
28.71	86.44	2.00	0.00	0.51	0.00	28.87	97.66	2.00	0.00	0.51	0.00
29.04	104.85	2.00	0.00	0.51	0.00	29.20	107.55	2.00	0.00	0.51	0.00
29.36	108.35	2.00	0.00	0.50	0.00	29.53	110.46	2.00	0.00	0.50	0.00
29.69	114.51	2.00	0.00	0.50	0.00	29.86	116.79	2.00	0.00	0.49	0.00
30.02	114.96	2.00	0.00	0.49	0.00	30.18	110.65	2.00	0.00	0.49	0.00
30.35	109.23	2.00	0.00	0.49	0.00	30.51	112.70	2.00	0.00	0.48	0.00
30.68	118.37	2.00	0.00	0.48	0.00	30.84	121.38	2.00	0.00	0.48	0.00
31.00	123.42	2.00	0.00	0.47	0.00	31.17	124.54	2.00	0.00	0.47	0.00
31.33	126.35	2.00	0.00	0.47	0.00	31.50	125.50	2.00	0.00	0.47	0.00
31.66	123.37	2.00	0.00	0.46	0.00	31.82	121.05	2.00	0.00	0.46	0.00
31.99	123.20	2.00	0.00	0.46	0.00	32.15	129.07	2.00	0.00	0.46	0.00
32.32	136.74	2.00	0.00	0.45	0.00	32.48	140.99	2.00	0.00	0.45	0.00
32.64	142.23	2.00	0.00	0.45	0.00	32.81	139.71	2.00	0.00	0.44	0.00
32.97	134.99	2.00	0.00	0.44	0.00	33.14	127.96	2.00	0.00	0.44	0.00
33.30	120.68	2.00	0.00	0.44	0.00	33.46	114.93	2.00	0.00	0.43	0.00
33.63	110.11	2.00	0.00	0.43	0.00	33.79	107.74	2.00	0.00	0.43	0.00
33.96	106.70	2.00	0.00	0.42	0.00	34.12	107.78	2.00	0.00	0.42	0.00
34.28	106.52	2.00	0.00	0.42	0.00	34.45	104.47	2.00	0.00	0.42	0.00
34.61	105.53	2.00	0.00	0.41	0.00	34.78	112.01	2.00	0.00	0.41	0.00
34.94	119.20	2.00	0.00	0.41	0.00	35.10	118.15	2.00	0.00	0.41	0.00
35.27	110.75	2.00	0.00	0.40	0.00	35.43	102.75	2.00	0.00	0.40	0.00
35.60	101.33	2.00	0.00	0.40	0.00	35.76	103.49	2.00	0.00	0.39	0.00
35.93	106.81	2.00	0.00	0.39	0.00	36.09	111.44	2.00	0.00	0.39	0.00
36.25	116.52	2.00	0.00	0.39	0.00	36.42	121.68	2.00	0.00	0.38	0.00
36.58	124.49	2.00	0.00	0.38	0.00	36.75	126.59	2.00	0.00	0.38	0.00
36.91	124.39	2.00	0.00	0.37	0.00	37.07	121.97	2.00	0.00	0.37	0.00
37.24	120.05	2.00	0.00	0.37	0.00	37.40	122.38	2.00	0.00	0.37	0.00
37.57	126.35	2.00	0.00	0.36	0.00	37.73	128.74	2.00	0.00	0.36	0.00
37.89	130.28	2.00	0.00	0.36	0.00	38.06	128.70	2.00	0.00	0.35	0.00
38.22	128.64	2.00	0.00	0.35	0.00	38.39	127.97	2.00	0.00	0.35	0.00
38.55	128.07	2.00	0.00	0.35	0.00	38.71	125.14	2.00	0.00	0.34	0.00
38.88	122.40	2.00	0.00	0.34	0.00	39.04	121.83	2.00	0.00	0.34	0.00
39.21	124.05	2.00	0.00	0.34	0.00	39.37	126.61	2.00	0.00	0.33	0.00

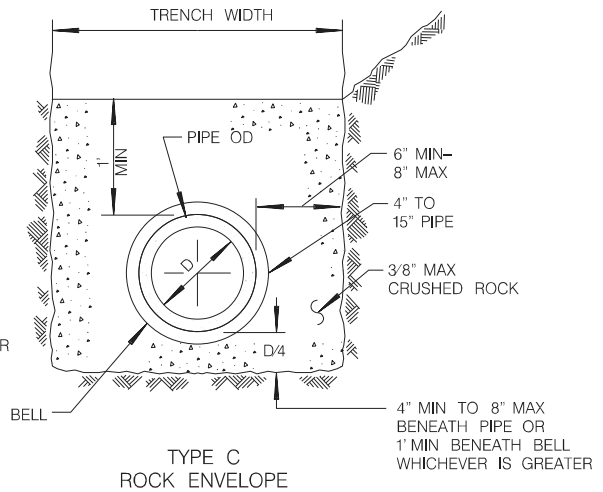
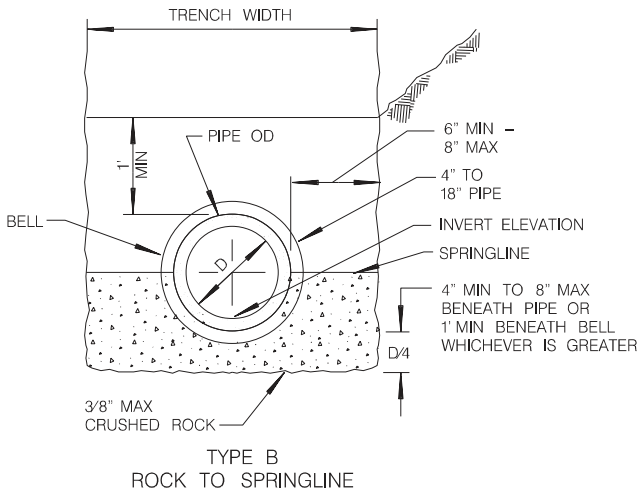
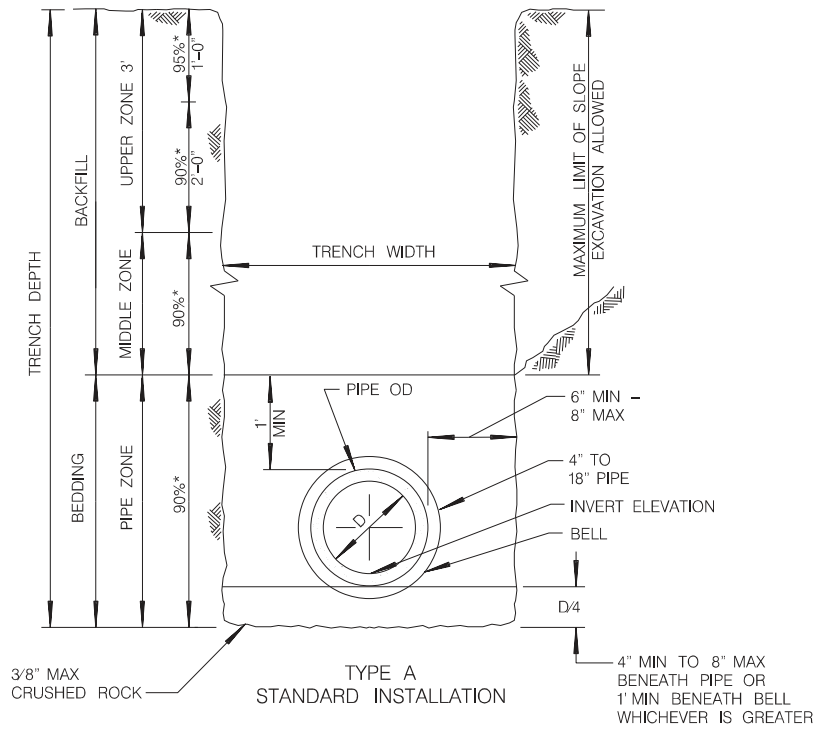
:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
39.53	126.32	2.00	0.00	0.33	0.00	39.70	121.07	2.00	0.00	0.33	0.00
39.86	113.82	2.00	0.00	0.32	0.00	40.03	108.01	2.00	0.00	0.32	0.00
40.19	108.51	2.00	0.00	0.32	0.00	40.35	110.28	2.00	0.00	0.32	0.00
40.52	110.53	2.00	0.00	0.31	0.00	40.68	108.74	2.00	0.00	0.31	0.00
40.85	109.04	2.00	0.00	0.31	0.00	41.01	111.47	2.00	0.00	0.30	0.00
41.17	114.92	2.00	0.00	0.30	0.00	41.34	116.18	2.00	0.00	0.30	0.00
41.50	116.81	2.00	0.00	0.30	0.00	41.67	115.24	2.00	0.00	0.29	0.00
41.83	112.92	2.00	0.00	0.29	0.00	41.99	110.11	2.00	0.00	0.29	0.00
42.16	110.06	2.00	0.00	0.29	0.00	42.32	110.42	2.00	0.00	0.28	0.00
42.49	110.37	2.00	0.00	0.28	0.00	42.65	111.09	2.00	0.00	0.28	0.00
42.81	111.94	2.00	0.00	0.27	0.00	42.98	113.95	2.00	0.00	0.27	0.00
43.14	113.85	2.00	0.00	0.27	0.00	43.31	114.67	2.00	0.00	0.27	0.00
43.47	113.41	2.00	0.00	0.26	0.00	43.64	110.79	2.00	0.00	0.26	0.00
43.80	105.30	2.00	0.00	0.26	0.00	43.96	98.52	2.00	0.00	0.25	0.00
44.13	93.17	2.00	0.00	0.25	0.00	44.29	92.12	2.00	0.00	0.25	0.00
44.46	94.56	2.00	0.00	0.25	0.00	44.62	99.03	2.00	0.00	0.24	0.00
44.78	102.39	2.00	0.00	0.24	0.00	44.95	107.62	2.00	0.00	0.24	0.00
45.11	113.25	2.00	0.00	0.24	0.00	45.28	120.35	2.00	0.00	0.23	0.00
45.44	123.22	2.00	0.00	0.23	0.00	45.60	121.57	2.00	0.00	0.23	0.00
45.77	116.80	2.00	0.00	0.22	0.00	45.93	113.53	2.00	0.00	0.22	0.00
46.10	112.49	2.00	0.00	0.22	0.00	46.26	108.77	2.00	0.00	0.22	0.00
46.42	105.37	2.00	0.00	0.21	0.00	46.59	103.38	2.00	0.00	0.21	0.00
46.75	107.36	2.00	0.00	0.21	0.00	46.92	112.49	2.00	0.00	0.20	0.00
47.08	115.23	2.00	0.00	0.20	0.00	47.24	112.98	2.00	0.00	0.20	0.00
47.41	106.68	2.00	0.00	0.20	0.00	47.57	100.09	2.00	0.00	0.19	0.00
47.74	97.99	2.00	0.00	0.19	0.00	47.90	99.89	2.00	0.00	0.19	0.00
48.06	103.45	2.00	0.00	0.19	0.00	48.23	103.74	2.00	0.00	0.18	0.00
48.39	103.65	2.00	0.00	0.18	0.00	48.56	103.65	2.00	0.00	0.18	0.00
48.72	106.60	2.00	0.00	0.17	0.00	48.88	109.65	2.00	0.00	0.17	0.00
49.05	113.00	2.00	0.00	0.17	0.00	49.21	115.27	2.00	0.00	0.17	0.00
49.38	116.13	2.00	0.00	0.16	0.00	49.54	115.20	2.00	0.00	0.16	0.00
49.70	112.72	2.00	0.00	0.16	0.00	49.87	109.00	2.00	0.00	0.15	0.00
50.03	106.03	2.00	0.00	0.15	0.00						

Total estimated settlement: 0.50**Abbreviations**

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumetric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

APPENDIX E



NOTES

1. FOR TRENCH RESURFACING IN IMPROVED STREETS, SEE STANDARD DRAWINGS SDG-107 AND SDG-108.
2. (*) INDICATES MINIMUM RELATIVE COMPACTION.
3. MINIMUM DEPTH OF COVER FROM THE TOP OF PIPE TO FINISH GRADE FOR PVC SDR 35 SEWER MAIN SHALL BE 5'. FOR SHALLOWER DEPTH, SPECIAL DESIGN IS REQUIRED. SEE SDS-101.
4. SEE TYPE A INSTALLATION FOR DETAILS NOT SHOWN FOR TYPES B AND C.
5. FOR PIPE SIZE ENCASUREMENT LARGER THAN 15", MAXIMUM SIDE WALL CLEARANCE SHALL BE 12" OR AS SHOWN ON THE PLANS.
6. 6" METAL TAPE SHALL BE INSTALLED ABOVE PIPE 4" BELOW TRENCH CAP AND 12" BELOW FINISH GRADE IN UNIMPROVED STREETS.
7. 1" SAND CUSHION OR A 6" MINIMUM SAND CUSHION WITH 1" NEOPRENE PAD SHALL BE PLACED FOR CROSSINGS UTILITIES WHEN VERTICAL CLEARANCE IS 1' OR LESS. THE NEOPRENE PAD SHALL BE PLACED ON THE MOST FRAGILE UTILITY.

From: City of San Diego Standard Drawing SDS-110 (2016)

LANDMARK
Geo-Engineers and Geologists
Project No.: LE20064

**Pipe Bedding and Trench Backfill
Recommendations**

**Plate
E-1**