

BID SET

**Cuyamaca College - Track and Field
Improvements PH. II - Scoreboard**

900 Rancho San Diego Pkwy, El Cajon, CA 92019

5028014-100

Grossmont-Cuyamaca Community
College District

8800 Grossmont College Dr., El Cajon, CA 92020

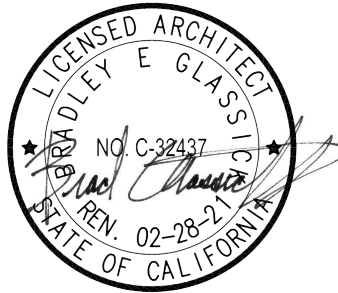


January 19, 2021

HMC Architects

**CUYAMACA COLLEGE TRACK AND FIELD
IMPROVEMENTS PH. II - SCOREBOARD
GROSSMONT-CUYAMACA COMMUNITY COLLEGE DISTRICT
EL CAJON, CA**

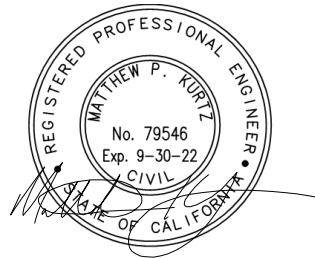
November 4, 2020
HMC # 5028014-100



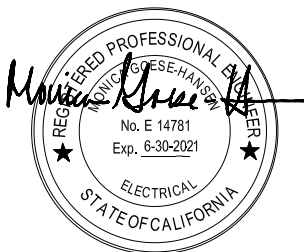
HMC ARCHITECTS
Architect



SAIFUL BOUQUET STRUCTURAL ENGINEERS
Structural Engineer



SNIPES-DYE ASSOCIATES
Civil Engineer



JOHNSON CONSULTING ENGINEER, INC.
Electrical Engineer

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SECTION 01 10 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY OF WORK

- A. This Contract includes work necessary for and incidental to execution and completion of

**Cuyamaca College Track and Field Improvements PH. II - Scoreboard
Grossmont-Cuyamaca Community College District
El Cajon, CA**

in accordance with Contract Documents dated November 4, 2020 prepared by HMC Architects 3546 Concourses Street, Ontario, California 91764.

1.02 GENERAL DESCRIPTION OF WORK

- A. Work under this Contract includes furnishing all labor, materials, services and transportation, except as specifically excluded which is required for completion of Project in accordance with provisions of Contract Documents.
- B. Work to be included as part of this Contract:
1. All constructions and services required for new Scoreboard.
- C. The following restrictions apply to access and to use of site and existing buildings:
1. Use of Site: Limit use of premises to Work in areas indicated. Confine operations to areas within Contract limits indicated. Do not disturb portions of site beyond areas in which Work is indicated. Allow for District occupancy and use by public.
 2. Driveways and Entrances: Keep driveways and entrances serving premises clear and accessible to District, District's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
 3. Partial District Occupancy: District reserves right to occupy and to place and install equipment in completed areas of building before Certified Completion, provided such occupancy does not interfere with completion of Work. Such placing of equipment and partial occupancy shall not constitute acceptance of total Work.

1.03 PERMISSIBLE WORKING DAYS AND HOURS

- A. Work may be conducted on regularly scheduled days between the hours of 7:00 A.M. and 5:00 P.M.
- B. Work may be conducted at any hour during Saturdays, Sundays and non-school session days, at no extra cost to the District, when written notification to District has been submitted and anticipated schedule of Work activities has been approved.

- C. Conform to Division 01, General Requirements for required payment for Inspector's services performed during overtime hours.

1.04 INTERRUPTION OF EXISTING UTILITY SERVICES

- A. When necessary to interrupt any existing utility service to make connections, minimum of 7 days advance notice shall be given to District and Program Manager and Architect. Interruptions in utility services shall be of shortest possible duration for Work at hand and shall be approved by Architect.
- B. In event any utility service is interrupted without required 7 days notice, Contractor shall be financially liable for all damages suffered by District due to unauthorized interruption.

1.05 VERIFICATION OF EXISTING CONDITIONS

- A. Contractor shall be responsible to examine site of Work and after investigation to decide for himself/herself character of materials, equipment and utilities to be encountered and all other existing conditions affecting Work. Contractor is also responsible to provide sufficient costs to cover provisions of all items of Work under existing conditions referred to herein.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Changes in the Work.
- B. Schedule of Values.

1.02 CHANGES IN THE WORK

- A. Approval by Division of the State Architect (DSA) Required: Changes in the Work affecting Structural Safety, Access or Fire and Life Safety, will be submitted for DSA approval, using Form DSA-140 (Application for Approval of Construction Change Document - Category A) in accordance with CAC Section 4-338(c), prior to commencing the work described therein. Changes not affecting Structural Safety, Access or Fire and Life Safety (Form DSA-141 Application for Concurrence of Construction Change Document - Category B) will not be submitted for approval, only if required by DSA in writing.
- B. Minor Changes in the Work: Architect will issue through the Program Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on ASI (Architect's Supplemental Instructions) or AIA Document G710, accompanied by Form DSA-141 or approved Form DSA-140.
- C. Proposal Requests
 - 1. Program Manager-Initiated Proposal Requests - Work Change Proposal Request (WCPR): Architect will issue the Program Manager a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time, on AIA Document G709 or Architect's form, referencing Form DSA-140 or DSA-141. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - a. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - b. Within time specified in the General and Supplementary Conditions after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - 1) Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 2) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 3) Include costs of labor and supervision directly attributable to the change.

- 4) Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 5) Quotation Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."
2. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Program Manager and Architect.
- a. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - b. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - d. Include costs of labor and supervision directly attributable to the change.
 - e. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - f. Comply with requirements in Section 01 60 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - g. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."
- D. Construction Change Directive to the Contractor
1. Construction Change Directive: Architect will issue through the Program Manager a Construction Change Directive on AIA Document G714 or Architect's form, accompanied by DSA-approved Form DSA-140 or Form DSA-141 or both, and completed WCPR (Work Change Proposal Request). Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Copy will be issued to the Project Inspector.
 - a. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
 2. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - a. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract, using CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

- E. Change Orders Procedures: On District's approval of a completed Construction Change Directive, Architect will prepare and issue through the Program Manager a Change Order for signatures of the District and Contractor on AIA Document G701 or Architect's form. Copies of signed Change Order will be distributed to Architect, IOR and Contractor, and submitted for Board Approval.
 - 1. Stipulated Price Change Order: Based on Contractor's Change Order Request as approved by Architect.
 - 2. Time and Material Change Orders: Submit itemized account and supporting data after completion of change within time limits indicated in Conditions of Contract. Architect will determine change allowable in Contract Price and Contract Time as provided in Contract Documents.
 - 3. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in Work.
 - 4. Refer to the General and Supplementary Conditions for additional requirements.
 - 5. Execution of Change Orders: The Program Manager will issue Change Orders for signature of parties as provided in Conditions of the Contract.

1.03 SCHEDULE OF VALUES

- A. Submit printed schedule on AIA Forms G702 and G703 - Application and Certificate for Payment and Continuation Sheet. Contractor's standard form or electronic media printout will be considered, submit sample forms to Architect for approval.
- B. Submit application for progress payment in accordance with the General and Supplementary Conditions.
- C. Submit Schedule of Values in duplicate within 15 calendar days after date of District-Contractor Agreement for Architect's approval.
- D. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of the major Specification Section. Identify site mobilization and bonds and insurance. On projects of more than one building, list buildings separately. List mechanical, electrical, plumbing and fire protection Work separately for each building and for site Work.
- E. Break down the plumbing and mechanical portions of the work at a minimum into a rough, finish, including air balance and electrical portion.
- F. Break out rough grading, fine grading, and underground utilities.
- G. Include separate line items, showing amount of General Contractor's overhead and profit, bonds and insurance, supervision, and then remainder of general items.
- H. Revise schedule to list approved Change Orders, with each Application for Payment.

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PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 26 10

REQUESTS FOR INFORMATION (RFI)

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Administrative requirements for Requests for Information (RFI).

1.02 DEFINITIONS

A. Request for Information:

1. Written request prepared by Contractor requesting additional information necessary to clarify an item which he believes is not clearly shown or called for in the drawings or specifications, or to address problems which have arisen under field conditions, hereinafter referred to as RFI.
2. Properly prepared request for information shall include detailed written statement that indicates specific Drawings or Specification in need of clarification and nature of clarification requested.
 - a. Drawings shall be identified by Drawing number and location on Drawing sheet.
 - b. Specifications shall be identified by Section number, page and paragraph.
3. Contractor's documents with similar titles, such as "Request for Interpretation" or "Request for Clarification" shall be considered RFIs.
4. RFIs and Architect's responses are not Changes in the Work; if a Change in the Work is required in response to an RFI, separate documents shall be issued in accordance with Section 01 20 00.

B. Improper RFIs:

1. RFIs that are not properly prepared or incomplete.
2. Improper RFIs will be processed by Architect at Architect's standard hourly rate and Architect will charge District, and such costs will be deducted from moneys still due the Contractor. Architect will notify Contractor before processing of improper RFIs.

C. Frivolous RFIs:

1. RFIs that request information that is clearly shown on Contract Documents.
2. Frivolous RFIs may be returned unanswered or may be processed by Architect at Architect's standard hourly rate and Architect will charge District, and such costs will be deducted from moneys still due Contractor. Architect will notify Contractor before processing of frivolous RFIs.

1.03 CONTRACTOR'S REQUESTS FOR INFORMATION

- A. When the Contractor is unable to determine from Contract Documents, material, process or system to be installed, Architect will be requested to make clarification of indeterminate item.

1. Whenever possible, such clarification shall be requested at next appropriate project meeting, with response entered into meeting minutes. When clarification at meeting is not possible, because of urgency of need, or complexity of item, Contractor shall prepare and submit RFI to Program Manager and Architect.
- B. Contractor shall endeavor to keep number of RFIs to a minimum. In the event the process becomes unwieldy, in the opinion of Architect, because of number and frequency of RFIs submitted, the Architect may require the Contractor to abandon process and submit future requests as either submittals, substitutions or requests for change.
- C. RFIs shall be submitted on form acceptable to Program Manager. Forms shall be completely filled in, and if prepared by hand, shall be fully legible after photocopying or transmission by facsimile (fax) or eMail scan. Each page of attachments to RFIs shall bear RFI number in lower right corner.
- D. RFI's shall be originated by Contractor:
 1. RFIs from subcontractors or material suppliers shall be submitted through, reviewed by, and signed by Contractor before submittal to Program Manager.
 2. RFIs sent by subcontractor or suppliers directly to the Program Manager or Architect or Architect's consultants shall not be accepted and will be returned unanswered.
- E. Contractor shall carefully study Contract Documents to ensure that requested information is not available therein. RFIs which request information available in Contract Documents will be deemed "improper" or "frivolous" as noted above.
- F. In cases where RFIs are issued to request clarification of coordination issues, for example pipe and duct routing, clearances, specific locations of Work shown diagrammatically, and similar items, Contractor shall fully lay out suggested solution using drawings or sketches drawn to scale, and submit same with RFI. RFIs which fail to include suggested solution will be returned unanswered with requirement that Contractor submit a complete request.
 1. Contractors are encouraged to utilize photocopies of Contract Documents to completely illustrate their questions, and to provide sketches as required to communicate question, concepts and suggestions.
- G. Do not use RFIs for following purposes:
 1. To request approval of submittals.
 2. To request approval of substitutions.
 3. To request changes which entail additional cost or credit.
 4. To request changes which entail change of time of completion.
 5. To request different methods of performing Work than those drawn and specified.
- H. In event Contractor believes that clarification by Architect results in additional cost or time, Contractor shall not proceed with Work indicated by RFI until Change Order or Construction Change Directive is prepared and approved in accordance with Section 01 20 00. RFIs shall not automatically justify cost increase in Work or change in project schedule.
 1. Answered RFIs shall not be construed as approval to perform extra Work.
 2. Unanswered RFIs will be returned with stamp or notation: Not Reviewed.

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- I. Contractor shall prepare and maintain log of RFIs, and at any time requested by Architect, Contractor shall furnish copies of log showing outstanding RFIs. Contractor shall note unanswered RFIs in log.
- J. Contractor shall allow up to 10 days review and response time for RFIs, however, Architect will endeavor to respond in timely fashion to RFIs.

1.04 ARCHITECT'S RESPONSE TO RFIs

- A. Architect will respond to RFIs on one of following forms:
 - 1. Properly prepared RFIs:
 - a. If no Change in the Work is required, Architect will respond in space provided on the RFI form.
 - b. If a Change in the Work is required, Architect will issue in accordance with Section 01 20 00.
 - 2. Improper or Frivolous RFIs:
 - a. Notification of Processing Fee(s).
 - b. Unanswered RFIs will be returned with stamp or notation: ÓNot Reviewed.
- B. Architect may opt to retain RFIs for discussion during regularly scheduled project meetings for inclusion of responses in meeting minutes in lieu of responding on written form.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Project Management and Coordination: Project Coordination, Mechanical and Electrical Coordination, Project Meetings.
- B. Construction Progress Documentation: Construction Progress Schedule, Project Management Control System, Construction Digital Photographs.
- C. Submittal Procedures: Shop Drawings, Product Data, Samples, Source Quality Control Reports,, Deferred Approval Items, Finishes Materials Schedule.

1.02 PROJECT COORDINATION

- A. Coordinate scheduling, submittals, and Work of various Sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify utility requirements and characteristics of 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.
- C. Coordinate space requirements and installation of mechanical and electrical Work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installation, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean up of Work of separate sections in preparation for Certified Completion and for portions of Work designated for District's occupancy.
- F. 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.

1.03 MECHANICAL AND ELECTRICAL COORDINATION

- A. Carefully coordinate interface between Divisions 21, 22, 23, and Division 26, before submitting any equipment for review or commencing installation.
- B. Control Wiring:

1. Consists of wiring in pilot circuits of contactors and starters, sensors, controllers, relays, and wiring for valve and damper operators.
- C. Connections:
 1. Provide connections to controls directly attached to ducts, piping and mechanical equipment with flexible connections.
- D. Starters:
 1. Provide magnetic starters or adjustable frequency drives for three phase motors and equipment complete with:
 - a. Control transformers.
 - b. 120 V holding coil.
 - c. Integral hand-off-auto switch.
 - d. Auxiliary contacts required for system operation plus one (1) spare.
- E. Control Voltage:
 1. Maximum allowable control voltage 120V/208V. Fully protect control circuit conductors in accordance with California Electrical Code.

1.04 PRECONSTRUCTION MEETING

- A. Program Manager will schedule meeting after Notice of Award.
- B. Attendance Required: Architect, Program Manager, Construction Manager if applicable, Prime Contractors, Major Subcontractors, Project Inspector, Director of Facilities Planning & Development, Director of Maintenance and College Facility Director.
- C. Agenda:
 1. Contract Agreement:
 - a. Transmit 5 signed originals of the Agreement to the District.
 - b. Transmit Attachment Certifications to the District.
 - c. Transmit Performance and Payment Bonds to the District.
 - d. Contractor to transmit Certificates of Insurance to the District.
 - e. District to transmit copy of Certificates of Property Insurance to Contractor.
 - f. Review General and Supplementary Conditions.
 2. Receive documentation from Contractor:
 - a. Construction Progress Schedule.
 - b. Schedule of Values.
 - c. List of Subcontractors with addresses and phone numbers.
 - d. List of Submittals and estimated date of submittal.
 3. Project Administration:
 - a. Application for Payment, Stop-Notice Release, Record Drawings.
 - b. Change Order Requests, Change Orders, Request For Proposals, Construction Change Directive/Instruction Bulletins. Preparation of Change Orders by Architect according to 2016 California Administrative Code, Code of Regulations Title 24 Part 1, Section 4-233 .
 - c. Submittals
 - d. Deferred Approval Submittals
 - e. Substitution procedures.
 - f. Site Meetings.

- g. Testing Laboratory.
- h. Verified Reports.
- i. Critical work sequencing and long-lead items.
- j. Designation of key personnel and their duties.
- k. Lines of communications.
- l. Procedures for RFIs.
- m. Procedures for testing and inspecting.
- n. Distribution of the Contract Documents.
- o. Preparation of record documents.
- p. Work restrictions.
- q. Working hours.
- r. Procedures for disruptions and shutdowns.
- s. Parking availability.
- t. Storage areas.
- u. Equipment deliveries and priorities.
- v. Security.
- w. Progress cleaning.
- 4. Special District Conditions:
 - a. Temporary Facilities.
 - b. Owner Occupancy.
 - c. Work by Owner.
 - d. Access to Site - District Contact.
- 5. Construction Process:
 - a. Contractor shall discuss overview of construction.
 - b. Contractor shall identify items to be selected by District and date selections must be made.
 - c. Contractor shall review special requirements for equipment, safety, and noise.
- 6. Pre-Job Conference:
 - a. Prevailing Wage Requirements.
 - b. Checklist and signatures.

- D. Program Manager or Construction Manager if applicable will record minutes and distribute copies within seven days after meeting to participants and those affected by decisions made.

1.05 PROGRESS MEETINGS

- A. The Program Manager will schedule and administer weekly meetings throughout progress of Work..
- B. The Program Manager will make arrangement for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required: Architect, Program Manager, Construction Manager if applicable, All Prime Contractors, Major Subcontractors and Suppliers, Project Inspector of Record, Director of Facilities Planning & Development, Director of Maintenance and College Facility Director as appropriate to agenda topics for each meeting.
- D. Agenda:

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Maintenance of Construction Progress Schedule.
7. Corrective measures to regain projected schedules.
8. Maintenance of quality and work standards.
9. Effect of proposed changes on progress schedule and coordination.
10. Other business relating to Work.
11. Deferred Approval submittals and timelines

- E. Architect will record minutes and distribute copies within seven days after meeting to participants, and those affected by decisions made.

1.06 PREINSTALLATION MEETING

- A. When required in individual Specification Sections, convene pre-installation meeting before starting Work of Section.
- B. Require attendance of parties directly affecting, or affected by, Work of specific Section.
- C. Notify Architect seven days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
 2. Review coordination with related Work.
- E. Contractor shall record minutes and distribute copies within three days after meeting to participants, Architect and those affected by decisions made.

1.07 SUBMITTAL PROCEDURES

- A. Transmit separate request for EACH Section submittal to Program Manager.
1. Bind submittals sturdily, neatly label covers.
 2. Include HMC Architects job number as it appears on Contract Documents.
 3. Include Authority Having Jurisdiction application or approval number.
- B. Submittal number shall use a sequential number followed by a hyphen then the Specification Section followed by a hyphen and then the revision number (e.g., 0001-051200-0). Resubmittals shall have the original number and include the revision number as the suffix (e.g., 0001-051200-1).
- C. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.
1. Provide name telephone number of individual 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 according to requirements of Work and Contract Documents. Stamped signatures or initials are not acceptable.
- E. Schedule submittals to expedite Project. Coordinate submission of related items.
 - 1. Make submittals according to Construction Schedule and adequate enough in advance of scheduled dates of installation to provide required time for reviews for securing necessary approvals for possible revision and re-submittal and for placing orders and securing delivery.
 - 2. Schedule submittals such that related materials and assemblies that support or are affected by the submitted materials are either submitted simultaneously or in order of installation sequence such that impacts and coordination can be evaluated as part of the review.
 - 3. Late submittals, not in accordance with the Schedule for Submission of Shop Drawings, Product Data and Samples• and the Construction Schedule, will not be considered an acceptable reason for initiating a substitution requests caused by late ordering and procurement of materials.
- F. Identify variations from Contract Documents and Product or system limitations that is detrimental to performance of completed Work.
- G. Substitutions: Submit only as approved per Section 01 60 00, state effect of approved substitution on construction schedule, and changes required in other work or products.
- H. District-Directed Substitution Approval: Substitution submittals specifically directed by District to be approved by the Architect for this project shall pertain to a specific item only. The Architect's stamped approval of District-Directed Substitution does not constitute approval for any other item, other projects or parts of project. A Change Order shall be prepared to effect the District's authorization of District-Directed Substitution.
- I. Provide space for Contractor and Architect review stamps.
- J. Revise and resubmit submittals in their entirety, identify changes made since previous submittal.
- K. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- L. Determine and verify field dimensions and conditions, materials, catalog numbers and similar data.
- M. Coordinate as required with all trades and all public agencies involved.
- N. Unless otherwise specifically authorized by Architect, make submittals in groups containing associated items within the same Section. Architect may reject partial submittals as not complying with provisions of this Section.

- O. Where individual Sections require structural calculations, prepare submittal under direction of qualified California Licensed Structural Engineer and shall bear the Engineer's stamp and signature.
- P. Format of Submittals: Submit Electronic Submittals, including but not limited to Product Data, Shop Drawings, Schedules, Certifications, tests, logs, for ease of information distribution. At Contractor's option he may submit standard printed data on reproducible media and in number of copies required per this Section and other project Sections. Identify submitted items that are applicable to the project, including any deviations, with arrows, clouds, or other distinct graphic, or in highlighted writing that can be reproduced with black and white copiers easily discernible from background information.
- Q. Submittals for Deferred Approved Items, refer to listed items in this Section and the specific requirements therein in addition to requirements above.

1.08 CONSTRUCTION PROGRESS SCHEDULE

- A. Submit Construction Progress Schedule in duplicate within 15 calendar days after the date on the Notice to Proceed for Architect's review.
 - 1. Schedule shall reflect amount of time stipulated in Agreement.
 - 2. If the Contractor proposes an earlier completion dated than stipulated in the Agreement, Change Order will be issued reflecting revised completion date at no change in Contract Sum.
- B. Revise and resubmit as required.
- C. Scheduling may utilize programs including: Microsoft Project Schedule, Primavera Project Planner (P3), Primavera SureTrak Project Manager®, Meridian Project Systems or similar programs addressing the requirements.
- D. Submit computer generated network analysis diagram in accordance with Section 01 32 16.13 using Critical Path Method, generally as outlined in Associated General Contractors of America (AGC) publication "Construction Planning and Scheduling", latest Edition.
- E. Indicate complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates and duration. Ownership of float time is shared commodity, not for exclusive use by either party. Use float time to make up Work behind schedule until float time is depleted. Submittals returned in less time than allowed by Contract, shall be used to reduce Contractor time extension requests.
- F. Indicate Milestones and target date and their activities including completion dates.
- G. No Time extensions will be granted nor delay damages paid until a delay occurs that impacts the schedule consumes all available float or contingency time available, and extends the work beyond the contract completion date.
- H. Indicate estimated percentage of completion for each item of Work at each submission.

- I. Schedule for Submission of Shop Drawings, Product Data and Samples: Incorporate - Schedule for Submission of Shop Drawings, Product Data and Samples in Construction Progress Schedule. This schedule shall include submittal dates required for shop drawings, product data, samples and product delivery dates, including Deferred Approval Items, if any, and including those items furnished by District. Provide time in schedule for Architect's review of submittals according to Contract Time. Allow 21 calendar days for submittals requiring consultants' review. Allow 30 calendar days for review submittals of Structural Steel in Section 05 12 00, Door Hardware in Section 08 71 00, Hollow Metal Frames-Welded in Section 08 12 13 and Hollow Metal Doors in Section 08 13 13.
- J. Submit revised schedules with each Application for Payment identifying changes since previous version.
- K. As a minimum allow 14 calendar days in schedule for final inspections before final acceptance. Include time to correct punch list items prior to final acceptance.
- L. Substantially Completed buildings, alterations, additions and relocatables: in projects consisting of different buildings, alterations, additions and relocatables, scheduled to be substantially completed and delivered to the District for beneficial occupancy prior to Final Completion of entire project, indicate in the Construction Schedule each building, alteration, addition and relocatable progress, completion date, Punch List items and time for completion of Punch list items.

1.09 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Contractor shall engage qualified persons to take construction digital photographs.
- B. Do not permit photography to be issued for any purpose without specific written authorization from the District.
- C. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1600 by 1200.
 - 1. Provide 2 sets (CD's) of copies to District.
- D. Date Stamp: Unless otherwise indicated, date and time stamp each photographs as it is being taken so stamp is integral to photograph.
 - 1. Identify each print with job name, location from which photograph was taken, photographer's name address and photograph number.
- E. Pre-Construction Photographs: Before starting construction, take 4 color photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property.
- F. Periodic Construction Photographs : Take 4 color photographs monthly , coinciding with cutoff date associated with each Application of Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken. Take photographs same time of day.

1. Field Office Prints: Retain 1 set of prints of periodic photographs in field office at Project site available at all times for reference. Identify photographs same as for those submitted to Architect.
2. Final Completion Construction Photographs: Take 8 color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.

1.10 SHOP DRAWINGS

- A. Within 14 days from Notice to Proceed, submit to Program Manager and Architect for review and acceptance, Schedule for Submission of Shop Drawings, Product Data and Samples, (Submission Schedule) listing required submittals and review dates. Schedule shall allow sufficient time for checking by Architect. Incorporate Submission Schedule in Construction Progress Schedule. Days: Calendar Days.
 1. Additionally, submit all Shop Drawings, Product Data and Samples according to the following guidelines. Guidelines are provided to allow Architect and Engineers adequate time for review and is not intended to dictate contractor's means and methods:
 - a. Contract of 60 to 90 days: Submit within 15 days from acceptance of Submission Schedule. Allow Architect 15 days to respond (defined as reviewed and returned). Re-submittals: allow contractor 7 days, allow Architect 10 days to respond.
 - b. Contract of 90 to 180 days: Submit within 30 days from Notice to Proceed. Allow Architect 15 days to respond. Re-submittals: allow Contractor 10 days, and Architect 15 days to respond.
 - c. Contract of 180 to 270 days: Submit within 45 days from Notice to Proceed. Allow Architect 21 days to respond. Re-submittals: allow Contractor 10 days, and Architect 15 days to respond.
 - d. Contract of 270 to 360 days: Submit within 60 days from Notice to Proceed. Allow Architect 21 days to respond. Re-submittals: allow Contractor 10 days, and Architect 15 days to respond.
 - e. Contract of 360 to 450 days: Submit within 60 days from Notice to Proceed. Allow Architect 21 days to respond. Re-submittals: allow Contractor 15 days and Architect 21 days to respond.
 - f. Contract of 450 days and longer: Contractor to schedule submittals. Allow Architect 30 days to respond. Re-submittals: allow Contractor 15 days and Architect 21 days to respond.
- B. Submit newly prepared information, drawn to accurate scale. Highlight, encircle or otherwise indicate deviations from Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to 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 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. Method of Review: Submit Electronic Shop Drawing Submittals. Identify submitted items that are applicable to the project, including any deviations, with arrows, clouds, or other distinct graphic, or in highlighted writing that can be reproduced with black and white copiers easily discernible from background information.
 - 1. Comments or corrections will be noted on submittals and returned to Contractor, who shall identify all changes made since previous submittal and resubmit in same manner. When reviewed, submittals will be electronically stamped and returned to Contractor who shall make distribution of electronic copies as required.
 - 2. Submit electronic Submittals directly to project website specifically established for the Project.
- E. Processing Time
 - 1. Allow enough time for submittal review, including time for re-submittals, as follows:
 - a. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
 - b. In accordance with the Schedule for Submission of Shop Drawings, Product Data and Samples. Review of each submittal for conformance with design concept of Project and with information given in Contract Documents. Architect's review of a separate item shall not indicate acceptance of assembly in which that item functions. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - c. Submittals requiring Consultants' Review: Where review of submittals by Architect's consultants is required, allow minimum 21 calendar days for review of each submittal. Allow minimum 30 calendar days for review submittals of Door Hardware, Section 08 71 00, Hollow Metal Frames - Welded Section 08 12 13 and Hollow Metal Doors, Section 08 13 13.
 - 2. Re-submittal Review: In accordance with the Schedule for Submission of Shop Drawings, Product Data and Samples for each re-submittal.
- F. Submittal of shop drawings to Architect, shall be made by Contractor with dated transmittal form or letter, and not by subcontractors or suppliers.
- G. Architect's review of shop drawings shall not relieve Contractor of responsibility for any deviation from requirements of Contract Documents unless Contractor has informed Architect in writing of such deviation at time of submission and Architect has given written acceptance to specific deviation, nor shall Architect's review relieve Contractor from responsibility for errors or omissions in shop drawings.
- H. No portion of Work requiring shop drawings shall be commenced until shop drawings have been returned with review by Architect.

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- I. At Contractor's option, he may request and if Architect approves use Architect's computer-generated drawings in electronic format. Contractor's request must be in writing with list of drawings requested and CAD format required. Contractor assumes all liability for accuracy of shop drawings if he opts to use Architect's drawings. Software for CAD formats requested by Contractor not currently available to Architect will be provided by Contractor at his own expense. Complete CAD Drawing Request Form at the end of this Section for request.
 1. Engineers' Drawings, CAD engineers' drawings are available only at discretion of the Engineer.

1.11 PRODUCT DATA

- A. Submit within time required by Shop Drawings.
- B. Submit five (5) copies. Three (3) copies will be retained by Architect.
- C. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- D. After review, distribute and provide copies for Record Documents.

1.12 SAMPLES

- A. Submit within time required by Shop Drawings.
- B. Submit samples to illustrate functional and aesthetic characteristics of product with integral parts and attachment devices. Coordinate sample submittals for interfacing Work.
- C. Submit samples of finishes from the full range of manufacturers' standard colors, textures and patterns for Architect selections, or in custom colors selected.
- D. Include identification on each sample with full Project information.
- E. Submit minimum of three (3) samples or as specified in individual Sections of Specifications, two (2) of which will be retained by Architect.
- F. Reviewed samples which may be used in the Work are indicated Sections of the Specifications, two (2) of which will be retained by the Architect.
- G. Selection or rejection of samples will be determined by Architect in writing.
- H. Colors: Materials that are visually related to other finishes require that subcontractors submit their samples before normally scheduled in order that color selection can be made for other items that are scheduled to be ordered earlier in construction schedule. Complete submittal of color charts and color samples shall be made before related colors will be selected Architect. Contractor shall be responsible to coordinate submittal schedules so as not to delay Work.

1.13 FINISHES MATERIALS SCHEDULE

- A. Submit in accordance with Submittal Procedures.

- B. Submit Schedule verifying lead times of materials and products as scheduled in Section 09 06 00, Schedules for Finishes.

1.14 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual Specification Sections, submit manufacturer's printed instruction for delivery, storage, assembly, installation, start-up, adjusting and finishing in quantities specified for product data.
- B. Identify conflicts between manufacturer's instructions and contract documents.

1.15 MANUFACTURER'S CERTIFICATIONS

- A. When specified in individual Specification Sections, submit manufacturers' certificate to Architect for review in quantities specified for product data.
- B. Indicate that 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.

1.16 SPECIAL PROCEDURES - ACCELERATION OF THE WORK

- A. If, in judgment of Architect or District, it becomes necessary at any time to accelerate Work or portion thereof, Contractor, when ordered or directed by Architect or District, shall deploy workers in such portions of Project where directed to enable others to properly engage and carry on their work.
 - 1. If circumstances require that entire Work or portion thereof be completed at date earlier than Contract Completion Date as adjusted by change orders, Contractor, when ordered or directed by District or Architect, shall increase his forces, equipment, hours of work, and/or number of shifts and shall expedite delivery of materials to meet the altered completion date or dates ordered or directed. Any increase in cost to Contractor in compliance with such orders or directives will be adjusted in accordance with Contact Documents.
- B. If, in judgment of Architect or District, Work is behind schedule and rate of placement of work is inadequate to regain scheduled progress so as to ensure timely completion of Work or separable portion thereof, Contractor, when so informed by Architect or District, shall immediately take action to increase rate of Work placement.
 - 1. This shall be accomplished by any one or combination of following or other suitable measures:
 - a. An increase in working forces,
 - b. An increase in equipment or tools,
 - c. An increase in hours of work or number of shifts,
 - d. Expediting delivery of materials.

2. Contractor shall, within ten (10) calendar days after being so informed, notify Architect of specific measures taken and/or planned to increase rate of progress together with estimate of when scheduled progress will be regained. Should plan of action be deemed inadequate by Architect or District, Contractor will take additional steps or make adjustments as necessary to his plan of action until it meets with Architect's or District's approval.
 3. Acceleration of Work will continue until scheduled progress is regained. Scheduled progress shall be established from latest revised approved progress schedule for Project.
 4. Timely completion will be understood as Contract Completion Date as revised by all time extensions granted at time acceleration is undertaken.
 5. Contractor shall not be entitled to additional compensation for additional effort he applies to Work under terms of this sub-paragraph.
- C. Any directive or order to accelerate Work will be in writing. Any directive or order terminating accelerated Work will be in writing.

1.17 PRECEDENCE

- A. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.
- B. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:
1. The Agreement.
 2. Addenda, with those of later date having precedence over those of earlier date.
 3. The Supplementary Conditions.
 4. The General Conditions of the Contract for Construction.
 5. Drawings and Technical Specifications.
 6. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.
 7. Any work called for in the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both.
 8. Contractor shall secure written permission from, Architect before proceeding with work affected by omission or discrepancies in the Contract.
- C. Separate sections of this Specification are arranged only for convenience of Contractor, and nothing stated herein should be misconstrued as suggesting jurisdiction over items of work by any different building trades.

1.18 PROJECT MANAGEMENT CONTROL SYSTEM

- A. System Requirements
1. The Contractor shall use the specified Internet based project management control system. The Contractor's requirements include:
 - a. Provide the hardware to operate the system in home and field offices.

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- b. 2 Licenses will be supplied by Grossmont-Cuyamaca to collaborate
- c. Provide personnel for training and operation of the system
- d. Provide an Internet Service Provider at all locations.
- e. Use the system to generate and transmit the specified project management documents.
- f. Use the system to communicate with Architect/Engineers, Project Manager and Inspector of Record.

B. System Description

- 1. The system is an Internet based construction management on-line project controls solution developed by Oracle Primavera Unifier. <https://www.oracle.com/applications/primavera/products/unifier.html> is the Internet site address.
- 2. The system is designed to address the record keeping and communication requirements of the construction project.
- 3. Document Control
 - a. Meeting Minutes: This feature will be utilized to track action items assigned to contractor during the weekly meetings.
 - b. Requests for Information: Submit all RFI's utilizing the system.
 - c. Submittal Register: Track and process all items being submitted by each subcontractor for approval.
 - d. Punchlist: Enter completion date(s) of punchlist items for sign off & approval.
 - e. Daily Reports: All Daily work journals will be entered in system

C. Ownership of Oracle Unifier database

- 1. Grossmont-Cuyamaca College retains control and ownership of the Unifier database during the duration and upon completion of the project.

D. Training

- 1. Grossmont-Cuyamaca will conduct a required 4 hour training session for the 2 licenses utilized by Contractor. Additional training sessions will be the responsibility of the Contractor and is available through Program Manager - Gafcon, Inc.
- 2. Training will be the responsibility of the Construction Manager and will be required to have each project participant attend a 4 hour training course prior to a user login being issued.
 - a. Initial training will be conducted at Grossmont or Cuyamaca training center.
 - b. Additional license cost = 1 license is \$1,800
 - c. Additional training contact Unifier Administrator -
 - 1) Loretta Walden at lwalden@gafcon.com or m:619-884-4500

1.19 DEFERRED APPROVAL ITEMS

- A. In accordance with 2016 California Code of Regulations Title 24, Part 1, California Administrative Code, Section 4-229 where certain items, equipment or portions of their installation cannot be fully detailed or structurally calculated before selection of specific manufacturer, items or portions thereof may be indicated in Documents or herein as "Deferred Approval Items".

- 1. Storefronts more than 10 feet high and 8 feet wide Section 08 41 13
- 2. Curtain Wall Systems more than 10 feet high and 8 feet wide Section 08 44 14

3. Window Systems per Section 08 51 13.
 - B. Items noted or listed in Contract Documents as "Deferred Approval" shall not be fabricated or installed until they have been approved by Division of the State Architect (DSA).
 - C. Submittals for approval shall be submitted within 30 days after Notice to Proceed to Architect for his review and signature before submitting to DSA.
 - D. For Deferred Approval Items provided by the Contractor, Contractor shall be responsible for providing details, structural calculations, stamps and signatures by Structural Engineer licensed in California, and other necessary data or material as required in the affected section and herein, and complete installation of items and equipment without extra cost to Owner. Provide to A/E of Record for approval.
 1. Storefront and Curtain Wall Submittals Section 08 41 13 and 08 44 14: Architect will submit Deferred-Approval items as follows in accordance with DSA procedures:
 - a. Architect will identify the number of types of storefront and curtainwall panels assemblies and the number of types of connections applicable to the project. Will submit only the particular details or elevations that reflect the various types of assemblies and connections used in the project and their associated calculations. 10 feet high and over, DSA deferred approval required.
 - b. Architect will stamp and sign the appropriate details for submittal to DSA. If not stamped and signed, include statement (when they utilize plans prepared by other licensed professionals) acceptable to DSA. A table of contents of plans submitted will follow the above statement. In the latter case, the plans and details shall be stamped by the design professional for the deferred approval items.
 - c. Submit plans numbered in sequence. Two sets of plans and one set of calculations will be submitted to DSA for review.
 - E. Detailed performance specifications and/or loading criteria for the deferred approval components must be included on the drawings or in the specifications. The drawings must include a list of the deferred approval components on the title sheet and clearly state that no work may proceed on the components until DSA stamped approved drawings are provided to the contractor and inspector for the components.
 - F. A/E of Record shall accept responsibility for verifying that all components (including those granted deferred approval) of the project are properly designed by appropriately licensed design professionals. The A/E of Record is also responsible for coordination of all components of the project. The A/E of Record is responsible for designing connections to the structure for all deferred approval components and verifying that all interactions (deflection compatibility, drift compatibility, vertical and lateral loads, etc.) are adequately addressed and in conformance with good engineering practices and the California Building Standards Code.
 - G. It should be noted no fixed time frame can be established for agency's approval. However, Contractor shall be responsible for time delays caused by his own late scheduling or incomplete drawings for deferred items.

PART 2 - PRODUCTS

2.01 MOTOR HORSEPOWER - MECHANICAL AND ELECTRICAL COORDINATION

- A. In general, motors larger than 1/2 Hp shall be three phase, motors 1/2 Hp or less shall be single phase.
- B. Voltage and phase of motors as scheduled on electrical drawings shall take precedence in case of conflict between mechanical and electrical drawings or requirements 2.01 A., above.
- C. Under Work of Divisions 21, 22, and 23 shall include coordination of mechanical equipment with requirements of Division 26 before ordering.
 - 1. If motors' horsepower are changed under Work of Divisions 21, 22, and 23 additional electrical cost of change shall be responsibility of Divisions 21, 22, and 23. Increase or decrease motor horsepower from that specified shall not be made without written approval from Architect.

2.02 PRODUCTS FOR PATCHING AND EXTENDING WORK

- A. Refer to Section 01 70 00 Execution Requirements.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

CAD DRAWING REQUEST FORM

Date: _____

HMC Job Number: _____

Project: _____

Project Architect: _____

We _____
Contractor

Request the following listed CAD file Sheet Numbers for use in the execution of our Work under the Contract Documents of the subject project, and hereby assume all and sole responsibility of field verification and coordination with the Work of associated trades.

The Contractor further agrees, to the fullest extent permitted by law, to indemnify and hold harmless the Architect, its officers, directors, employees and subconsultants (collectively, Architect) against any damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising from or allegedly arising from or in any way connected with the unauthorized reuse or modification of the electronic files by the Contractor or any person or entity that acquires or obtains the electronic files from or through the Contractor without the written authorization of the Architect.

Sheet No.	Dated	Sheet Title
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Requested File Format

☐ DWG (AutoCAD, 2012, 2015)

Requested File Deliverable

☐ CD Rom

☐ E-MAIL (Zipped Files)

Contractor's E-mail address

Contractors are not required to pay for the first 5 drawings (maximum). Additional drawings available at a rate of \$50.00 per drawing.

Total payment enclosed \$_____, (checks made payable to HMC Architects).

Signed: _____

Title: _____

Company: _____

Address: _____

Telephone: _____

Contact: *HMC Architects Inc.*
Project Manager

END OF FORM

SECTION 01 32 16.13
NETWORK ANALYSIS SCHEDULES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. References
- B. Quality Assurance.
- C. Format
- D. Schedule
- E. Submittals
- F. Review and Evaluation.
- G. Updating Schedule.
- H. Distribution

1.02 REFERENCES

- A. "Construction Planning and Scheduling", The Associated General Contractors of America (AGC), Washington, D.C., Latest Edition.

1.03 QUALITY ASSURANCE

- A. Scheduler: Contractor's Personnel specializing in CPM scheduling with one year minimum experience in scheduling construction Work of complexity comparable to this Project, and having use of computer facilities capable of delivering detailed graphic printout within 48 hours of request.
- B. Contractor's Administrative Personnel: One year minimum experience in using and monitoring CPM schedule on comparable projects.

1.04 FORMAT

- A. Scheduling may utilize programs (Latest Editions) including Microsoft Project, Primavera Project Planner for Windows (P3), Primavera SureTrack Project Manager, Meridian Project Systems or similar programs addressing the requirements.
- B. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with applicable Specification section number with scale and spacing to allow for notations and revisions.
- C. Diagram Sheet Size: 30 inches high by width required.

- D. Scale and Spacing: To allow for notations and revisions.

1.05 SCHEDULE

- A. Prepare Network Analysis Schedule and supporting mathematical analyses using Critical Path Method, under concepts and methods outlines in AGC's "Construction Planning and Scheduling".
- B. Diagrams to illustrate order and interdependence of activities and sequence of Work, how start of given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.
- C. Illustrate complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates and duration. Provide dates for procurement and delivery of critical products and dates for installation and provision for testing. Provide legend for symbols and abbreviations used. Indicate fabrication, delivery and installation activities.
- D. Incorporate Schedule for Submission of Shop Drawings and Samples. Submittal dates required for shop drawings, product data, samples and product delivery dates, including those furnished by District. Provide time in schedule for review of submittals.
- E. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates and identifying for each activity:
 - 1. Preceding and following event number.
 - 2. Activity description.
 - 3. Estimated duration of activity, in maximum 15 day intervals.
 - 4. Earliest start date.
 - 5. Earliest finish date.
 - 6. Actual start date.
 - 7. Actual finish date.
 - 8. Latest start date.
 - 9. Latest finish date.
 - 10. Lag time, total and free float for each activity and critical path.
 - 11. Monetary value of activity, keyed to Schedule of Values.
 - 12. Manpower and cost loading of scheduled activities.
 - 13. Percentage of activity completed.
 - 14. Responsibility
- F. Analysis Program: Capable of compiling monetary value of completed and partially completed activities of accepting revised completion dates and re-computation of all dates and float.
- G. Required Sorts: 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. By responsibility in order of earliest possible start date.
 - 4. In order of latest allowable start dates.
 - 5. In order of latest allowable finish dates.
 - 6. Contractor's periodic payment request sorted by Schedule of Values.

- 7. Listing of basic input data that generates report.
- 8. Listing of activities on critical path.

H. Coordinate contents with Schedule of Values.

I. Contractor shall not sequester float through strategies including extending activity duration estimates to consume available float, using preferential logic, using extensive or insufficient crew or resource loading, use of float suppression techniques, special lead or lag logic restraints or imposed dates.

J. Provide dates for procurement and delivery of critical products.

K. Include dates for installation and provisions for testing.

L. Provide legend for symbols and abbreviations used.

M. indicate fabrication, delivery and installation activities.

1.06 SUBMITTALS

A. PRELIMINARY Network Analysis Schedule: Within 14 days after date established in the Notice to Proceed, submit proposed PRELIMINARY Network Analysis Schedule defining planned operations for first 60 days of Work, with general outline for remainder of Work.

B. Network Analysis Schedule: Within 20 days after joint review of proposed PRELIMINARY Network Analysis Schedule, submit proposed COMPLETE Network Analysis Schedule for review consisting of network diagrams and mathematical analysis. Include written certification that mechanical, and electrical subcontractors have reviewed and accepted proposed schedule and allow for sufficient time for Program Manager's and Architect's review.

C. Participate in review of Preliminary and Complete Network Analysis Schedule jointly with Architect.

D. Number of opaque reproductions Contractor requires, plus three copies which will be retained by Architect.

E. One reproducible transparency and one opaque reproduction.

F. All schedule submittals, including progress updates for duration of Work, shall include electronic submittal in original file format, by e-mail or delivered on storage media agreed to by the project team..

G. Updated network schedule with each Application for Payment.

1.07 REVIEW AND EVALUATION

A. Participate in joint review and evaluation of network diagrams and analysis with Architect at each submittal.

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- B. Evaluate project status to determine Work behind schedule and Work ahead of schedule.
- C. After review, revise as necessary as result of review and resubmit within 10 days.

1.08 UPDATING SCHEDULE

- A. Maintain schedule to record actual start and finish dates of completed activities.
 - 1. Submit updated schedule at each scheduled project meeting or monthly, whichever is more frequent.
- B. Indicate progress of each activity to date of revision with project completion date of each activity. Update diagrams to graphically depict current status of Work.
- C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- D. Indicate changes required to maintain Date of Certified Completion.
- E. Submit sorts required to support recommended changes.
- F. Provide narrative report to define problem areas, anticipated delays and impact on Schedule. Report corrective action taken, or proposed and its effect including effect of change on schedule of separate contractors.

1.09 DISTRIBUTION

- A. Following joint review, distribute copies of updated schedule to Contractor's project site file, to Subcontractors, Suppliers, Architect, District and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedule.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Reference Standards.
- B. Quality Assurance and Control of Installation.
- C. Field Samples.
- D. Mock-up
- E. Project Inspector and Inspections.
- F. Permits and Fees.
- G. Verified Reports.
- H. Manufacturers' Field Services and Reports.
- I. Laboratory Testing Services.

1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. For products or workmanship specified by Association, Trade or Federal Standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- C. Obtain copies of standards when required by Contract Documents.
- D. Maintain copy of standards at jobsite during submittals, planning and progress of the specified Work until Certified Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.
- F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, products, services, site conditions and workmanship to produce Work of specified quality.

- B. Comply fully with manufacturers' instructions including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Perform Work by persons qualified to produce workmanship of specified quality.
- E. Where experience minimums for workmen, applicators, companies or manufacturers are required in individual Sections, written certification and documentation substantiating such minimums shall be submitted and approved by the Architect, when requested.
- F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.
- G. Field Samples
 - 1. Obtain field samples for review by Architect.
- H. Mock-Up
 - 1. Test will be performed under provisions identified in this Section.
 - 2. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals and finishes.
 - 3. Where mock-ups are specified in individual Sections, shall be removed after approval per this Section unless are to remain as part of the Work.

1.04 PROJECT INSPECTOR

- A. An Inspector, herein referred to as the "Project Inspector", "Job Inspector", or "Inspector of Record" (IOR) will be employed by the District approved by the Architect, Structural Engineer, and the Division of State Architect (DSA) in accordance with 2016 California Code of Regulations, Title 24, Part 1, California Administrative Code, Section 4-333(b). The Inspector of Record's duties are described in CAC Section 4-342, and DSA Procedure 13-01.
- B. Class of Inspector required for this project in accordance with Title 24, Part I, Section 4-333.1.
- C. The Work of construction in all stages of progress shall be subject to the personal continuous observation of the Project Inspector. He shall have free access to any or all part of the Work at any time. 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. Inspection of the Work shall not relieve the Contractor from any obligation to fulfill this Contract.

1.05 PERMITS AND FEES

- A. Where required by the provisions of individual sections of the Specifications, and where required to carry out construction operations, Contractor shall obtain and pay for permits and fees, including, but not limited to, Demolition, Grading, Disposals, requirements of Water, Gas, Sewer, Flood and Sanitary Districts, Municipal and County Building Departments having jurisdiction.
 - 1. Fees for final utility connections shall be paid by the Contractor and reimbursed to the Contractor by the District at direct cost.
 - 2. Building Permits or approvals issued by DSA requiring fees will be obtained and paid by the District.

1.06 VERIFIED REPORTS

- A. Contractor shall comply with CAC Sections 4-336 and 4-343 and issue verified reports through the Architect as required. The Program Manager and District shall be copied on all verified reports.

1.07 MANUFACTURERS' FIELD SERVICES AND REPORTS

- 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 of equipment and as applicable and to initiate instructions when necessary.
- B. Manufacturers' representatives shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions submitted to the Program Manager, Architect, and District..
- C. Submit report of observation to Architect for review.

1.08 CODES AND REGULATIONS

- A. All work pertaining to and all materials supplied for executing and completing this Contract shall comply with provisions specified in the Contract Documents and with all applicable laws, regulations and ordinances governing Work including, but not necessarily limited to, those of:
 - 1. California Code of Regulations (CCR), Title 24, California Building Standards Code
 - a. CAC - 2016 California Administrative Code, 24 CCR Part 1
 - b. CBC - 2016 California Building Code, 24 CCR Part 2, Volumes 1 and 2 (Ü15 IBC w/CA Amendments)
 - c. CEC - 2016 California Electrical Code, 24 CCR Part 3 ('11 NEC w/CA Amendments)
 - d. CMC - 2016 California Mechanical Code, 24 CCR Part 4 ('12 UMC w/CA Amendments)
 - e. CPC - 2016 California Plumbing Code, 24 CCR Part 5 ('12 UPC w/CA Amendments)
 - f. 2016 California Energy Code, 24 CCR Part 6

- g. CFC - 2016 California Fire Code, 24 CCR Part 9 ('12 IFC w/CA Amendments)
 - h. CALGreen - 2016 California Green Building Standards Code, 24 CCR Part 11
 - i. CRSC - 2016 California Reference Standards Code, 24 CCR Part 12
 - 2. California Code of Regulations (CCR), Title 19, Public Safety, Division 1, State Fire Marshal.
 - 3. Addenda Compliance per CBC Section 4-338(b), Part 1.
- B. Administrative Regulations, CCR Title 24, Part 1, California Administrative Code, Chapters 1, 4, 5:
 - 1. DSA not subject to Arbitration.
 - 2. Copy of Part 1 and Part 2, Volume 1 and 2 (CBC), and Parts 3 through 5 of Title 24 CCR, shall be kept and made available at the construction site office during construction.
- C. ADA - Americans with Disabilities Act of 1990, as amended
 - 1. Standards Ó ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.
- D. Enforcement includes all other codes, regulations, or standards referenced in the above listed codes.
- E. The preceding listed codes, regulations and ordinances of the regulatory agencies are hereby made a part of this Contract. Nothing in the Contract shall be construed as allowing any violation of any provision of any of above listed documents. Maintain copies of Codes listed above at the construction site.
- F. Threaded Steel Anchor Bolts and Anchor Rods requirements: DSA Interpretation of Regulation IR 17-11 requirements for identification, sampling and testing of threaded steel anchor bolts and anchor rods used for anchor structural elements to foundations.
 - 1. Anchor bolt and anchor rod materials identifications, sampling and testing shall be performed in accordance with IR 17-11 and the applicable standards. Anchor bolts and anchor rods not readily identifiable by physical markings, nor traceable by documentation accompanying the material's shipment, shall be treated according:
 - a. Sampled and tested to established conformity to the project documents.
 - b. Remove from the jobsite and replaced with identifiable material.
 - 2. Copy of DSA IR 17-11 may be obtained at:
www.dgs.ca.gov/dsa/Resources/IRManual.aspx
- G. The intent of these drawings and specifications is that the work of the alteration, rehabilitation or reconstruction is to be in accordance with Title 24, California Code of Regulations. Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the contract documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required work shall be submitted to and approved by DSA before proceeding with the work.

- H. Should any existing conditions such as deterioration or noncomplying construction be discovered which is not covered by the DSA approved documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.

1.09 VARIATIONS WITH LAWS

- A. If Contractor, his subcontractors or suppliers, or any of their employees ascertain at any time that requirements of this Contract conflict with or are in violation of applicable laws, codes, regulations and ordinances he shall not proceed with Work in question, except at his own risk. Contractor shall be required to remove that Work from site and replace such Work with all complying Work at no additional cost to District.

1.10 SELECTION AND PAYMENT - TESTING LABORATORY AND SPECIAL INSPECTORS

- A. The District will employ and pay for services of independent Testing Laboratory and Special Inspectors approved by Architect and DSA to perform inspection and testing in accordance with Part 1, Title 24, Section 4-335, California Code of Regulations and this Section.
- B. Offsite fabrication requiring Inspection and Testing: submit the qualifications of Inspectors and laboratory, including proposals for services, to the District, Program Manager and Architect for approval of qualifications and costs. Inspectors and laboratories shall conform to the requirements of Part 1 Title 24 Section 4-335.
- C. Inspector of Record (IOR) / Testing Laboratory Travel Expenses
 1. Initial Testing. For initial testing required by this Manual, District shall pay IOR, Testing Laboratory or both, for travel expenses, including mileage, room and board, when travel for inspection and testing of products purchased by the Contractor exceeds 50 miles or 2 hours from the project site.
 2. Additional Testing. When initial testing fails, IOR and Testing Laboratory travel expenses, as described above, attributable to required retesting shall be borne by the Contractor and will be deducted by Change Order from funds due and payable, or that become due and payable to Contractor.
 3. IOR, Testing Laboratory or both, as applicable, shall forward billings and records of such expenses to the District.
- D. When tests and inspections are required on an overtime basis, initial payment will be made by District . At termination of Work or completion of Project, all costs for overtime testing and inspections will be deducted from Contractor's final payment (or any funds due and payable) by Change Order.
- E. Before the Testing Laboratory files testing and inspection billings with District, they shall be billed indicating segregated straight time from overtime costs. All overtime costs shall be substantiated with detailed explanation for necessity of such work costs.

- F. When materials tested fail to meet requirements herein specified, they shall be promptly corrected or removed and replaced, re-inspected and retested in a manner required by the Architect. Costs involved in re-inspection and retesting will be paid by the District and deducted from Contractor's final payment (or any funds due and payable) by Change Order.
- G. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.11 LABORATORY RESPONSIBILITIES

- A. Laboratory shall be licensed to conduct testing and inspection operations in California and shall be approved by DSA. It shall be supervised by a State Licensed Civil Engineer who shall certify and sign all reports.
- B. Provide qualified personnel at site. Cooperate with Architect, Project Inspector and Contractor in performance of services.
- C. Perform specified inspection, sampling and testing of products in accordance with standards specified herein.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Architect, Project Inspector and Contractor by letter of observed irregularities or non-conformance of Work or products.
- F. Perform additional inspections and test required by Architect or governing agencies.
- G. Immediately upon Testing Laboratory determination of a test failure, the laboratory shall telephone the results of test to Program Manager and Architect. On the same day, laboratory shall send written test results to those named on the distribution list below.

1.12 LABORATORY REPORTS

- A. After each inspection and test, promptly submit one copy of laboratory report to the following:
 - 1. District
 - 2. Contractor
 - 3. Inspector of Record (IOR)
 - 4. Special Inspectors: Special Inspector's Verified Reports as required by Section 4-336 and shall be submitted in a timely manner.
 - 5. Architect
 - 6. Structural Engineer
 - 7. Mechanical and Electrical Engineers (Related Tests and Inspections).
 - 8. Division of the State Architect (DSA)
- B. Include:
 - 1. Date issued.
 - 2. Project title, Architect's number, DSA Application and File number.

3. Name of inspector.
 4. Date and time of sampling and Specifications Section.
 5. Identification of product and Specifications Section.
 6. Location in the Project.
 7. Type of inspection or tests.
 8. Date of test and ambient conditions at time of test.
 9. Results of tests.
 10. Conformance with Contract Documents.
 11. Signature by Registered Professional Engineer licensed in California.
 12. Statement that tests were conducted in accordance with Parts 1 and 2, Title 24, California Code of Regulations.
- C. Test reports shall include tests made, whether such tests indicate that the material performed satisfactorily or not. Samples taken but not tested shall be reported. Reports shall show that the materials were sampled and tested in accordance with the requirements of the approved Specifications. Reports shall show the specified design strength and shall state whether or not the materials tested comply with requirements. Report special sampling operations where required.
- D. Submit a report verifying that tests and inspections herein specified and otherwise required have been completed and material and workmanship complies with the Contract Documents. Such verification reports shall be submitted at the completion of the Project and at any time the Project is suspended. Parties to receive such reports are the same as listed above.
- E. When requested by Architect, provide interpretation of test results.
- 1.13 LIMITS ON TESTING LABORATORY AUTHORITY
- A. Laboratory may not release, revoke, alter or enlarge on requirements of Contract Documents.
 - B. Laboratory may not approve or accept any portion of the Work.
 - C. Laboratory may not assume any duties of Contractor.
 - D. Laboratory has no authority to stop the Work.
 - E. Laboratory shall not interpret code in relation to the design of the building.
- 1.14 CONTRACTOR RESPONSIBILITIES
- A. Administration of construction by Contractor per CAC Sections 4-330 and 4-343.
 - B. Deliver to laboratory at designated location, adequate samples of materials proposed to be used which require testing. Selection of materials required to be tested shall be by the Lab or District's Representative and not by the Contractor.
 - C. Cooperate with laboratory personnel, District's Representative, Project Inspector and the Architect, and provide access to the Work including weekends and after work hours and to manufacturer's facilities.

- D. Provide incidental labor materials and facilities to provide at all times, safe access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
- E. Notify Architect, Project Inspector and laboratory 48 hours prior to expected time for operations requiring inspection and testing services. Contractor shall pay for costs incurred if testing or inspections are cancelled and are required to be rescheduled due to the Contractor's failure to notify the Project Inspector in advance as required. Also, notify District in advance of manufacturer of materials to allow testing at source of supply.
- F. In accordance with CBC-17A, Section 1706A, Contractor shall execute and submit a Statement of Responsibility regarding special inspections and testing required for principal wind- and seismic-load bearing systems to the Inspector of Record and the Project Inspector, Program Manager and Architect.
- G. The District, Project Inspector, or the Architect shall have the right to reject materials and workmanship that are defective or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without cost to the District. If the Contractor fails to correct such rejected Work within a reasonable time, fixed by written notice, the District will correct same and charge the expense to the Contractor by Change Order.
- H. Should it be considered necessary or advisable by the District at any time before date of completion of the entire Work to make an examination of Work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such Work is found to be defective in any respect due to fault of the Contractor or his subcontractor, all extra expenses shall be charged to the Contractor by Change Order. If however such Work is found to meet the requirements of the Contract Documents, the additional cost of labor and materials involved in the examination and for replacement costs shall be allowed to the Contractor by Change Order.
- I. When changes of construction schedule are necessary during construction, coordinate such changes with the Testing Laboratory as required.
- J. When the Testing Laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, extra charges for testing attributable to the delay shall be charged to the Contractor by Change Order.
- K. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.
- L. Selection of materials to be tested shall be made by the Testing Laboratory or the Project Inspector and not by the Contractor.
- M. Any material shipped by the contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required, shall not be incorporated in the Work.

1.15 SCHEDULE OF STRUCTURAL TESTS AND INSPECTIONS

- A. Refer to Form DSA-103, Statement of Structural Tests and Inspections, attached hereto.

1.16 MOISTURE AND ALKALINITY, AND RELATIVE HUMIDITY TESTING

- A. Field Testing of concrete slabs, moisture testing per ASTM F1869 -2009. The test area should be at the same temperature and humidity expected during normal use, minimum testing conditions shall be 75 ± 10 degrees F. and $50 \pm 10\%$ relative humidity. Maintain these conditions 48 hours prior to, and during testing.
- B. Field Testing of concrete slabs, relative humidity per ASTM F2170.
- C. Field Testing of concrete slabs, resilient flooring per ASTM F710.
- D. Alkalinity testing: per ASTM F710, ranges shall not exceed those recommended by the flooring manufacturer.

1.17 EXPANSION BOLTS OR EPOXY-TYPE ANCHORS - APPROVED ANCHORS

- A. Basis of Design Capacities: Design capacities for expansion type and epoxy (adhesive) type anchors should reflect the tested capacity of the anchors including the degree of scatter in the recorded peak loads and the load-displacement response, the type and mechanical properties of the concrete or masonry in which the anchor is installed, anchor edge distance and spacing, and whether the anchors are installed through metal decking into concrete fill. In addition, the potential for concrete cracking in the vicinity of the anchor during its service life and the effect of such cracking on the capacity of the anchor to resist loads shall be considered. The effects of temperature variations on epoxy (adhesive) type anchors shall also be taken into account where applicable. The age, composition and mechanical properties of the materials in which the anchor will be installed shall be evaluated.
- B. The relevant mechanical properties include unit weight, compressive strength, and aggregate size and type. Evaluation of compressive strength on the basis of cores taken at or near the anchor locations shall be permitted. The compressive strength of the material in which the anchor will be installed shall meet or exceed the compressive strength of the material in which the anchor was tested.
- C. Expansion-type anchors: Concrete
 1. Kwik Bolt TZ (KB-TZ) Concrete Anchor, 3/8 to 3/4 inch diameter, ICC ESR-1917, by Hilti Inc., Tulsa, OK.
 2. Simpson Strong-Bolt 2 concrete anchor, 1/2, 5/8, 3/4 and 1 inch diameter, ICC ESR-3037, by Simpson Strong-Tie, Pleasanton, CA ,
 3. Or equal with ICC Report Number.
- D. Epoxy-Type Adhesive Anchors:
 1. For fully grouted CMU, lightweight concrete construction
 - a. HIT HY-70 by Hilti, ICC ER-2682.
 - b. Or equal with ICC Report Number.
 2. For Normal Weight concrete with min. compressive of 2500 psi or 4000 psi.

- a. HIT RE 500-SD Adhesive Anchor System by Hilti, ICC ESR-2322.
 - b. SET-XP adhesive by Simpson Strong-Tie, ICC ESR-2508
 - c. Or equal with ICC Report Number.

- E. Expansion-type anchors. Expansive type anchors may be used, provided the allowable shear and tension loads are determined by test in accordance with following:
 - 1. The allowable values listed in an ICC-ES Evaluation Service Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC 01, latest revision, including the seismic qualification tests of AC 01 Section 5.6. Strength design values may be used provided the anchors have been tested in accordance with AC193, latest revision, including the seismic qualification tests of ACI 355.2 Sections 9.6 and 9.7 and Annex 1 of AC-193.
 - 2. For anchors installed in the underside of a beam/slab, the allowable tension load design values should be based on the tabulated value of the anchors installed without special inspection (special inspection is still required), unless allowable load values for anchors installed in cracked concrete are provided in the ICC-ES Report, or the anchors have been tested in accordance with ACI 355.2, latest revision, Table 5.2 and Annex 1 of AC-193, or ACI-318-11 Appendix D. Shear values are based on the tabulated values in the ICC-ES Report. Once an ICC-ES Report complying with AC-193 has been issued, it shall take precedence over any previous report.
 - 3. If anchors have not been tested in accordance with the requirements for seismic qualification tests of AC 01, Section 5.6, the allowable load values listed in the ICC-ES Report may be used with the following modifications:
 - a. Allowable shear and tension loads shall be limited to 80% of the tabulated allowable values for anchors installed with special inspection.
 - b. For anchors installed in the underside of a beam/slab, the allowable tension load should be based on 80% of the tabulated allowable value for anchors installed without special inspection (special inspection is still required). Allowable shear values should be based on ϕ_a above.

- F. Epoxy-type anchors. Epoxy-type (adhesive) anchors include anchors that rely on organic and inorganic compounds (including) epoxies, polyurethanes, methacrylates and vinyl esters) to develop the bond to the concrete.
 - 1. The use of shallow epoxy-type (adhesive) anchors to resist direct tension loads where concrete cracking may occur is not permitted. Shallow epoxy-type (adhesive) anchors are those with an embedment to diameter ratio less than 8.
 - 2. Epoxy-type (adhesive) anchors should only be installed in conditioned, interior spaces. Where epoxy type anchors are used as shear dowels at the perimeter of an existing opening (slab or wall) to be filled with concrete, or are being used to connect new concrete elements to existing concrete elements (e.g. gunite), they may be installed in exterior locations with prior approval by DSA.
 - 3. If epoxy-type (adhesive) anchors are exposed to fire, all anchors in the affected area shall be inspected and evaluated by a qualified person to ensure their load carrying capability has not been compromised.
 - 4. The design shear and tension capacities of epoxy-type anchors must be determined in accordance with the following:

- a. The allowable loads may be based on the values listed in an ICC ES Report that complies with requirements of AC 58 for a specific anchor in the same configuration as tested. Supporting data shall include the Seismic Qualification test performed in accordance with procedures of Section 5.3.7 of AC 58.
 - b. Where epoxy-type (adhesive) anchors are used for structural applications, such as dowels between new and existing concrete the anchors shall be installed in a manner such as that the ultimate tensile capacity is controlled by the ultimate strength of the steel element.
 - G. When epoxy-type (adhesive) anchors are used to resist tensile forces in structural applications, the minimum depth of embedment shall be greater than or equal to the development length, l_d , determined in ACI 318-11 for a cast-in-place reinforcing bar of the same diameter and grade when considering a tensile splitting failure mode. Where tensile splitting need not be considered, the depth of embedment, may be determined in accordance with Appendix D of ACI 318-11 as amended by Section 3.3 of AC 308.
 - H. Embedment, Spacing, and Edge Distance: All anchors shall meet the minimum embedment, spacing, edge distance, and slab thickness criteria established by the relevant ICC-ES Report.
 - 1. Unless otherwise noted in the Report, the edge distance should be a minimum of ten (10) bolt diameters from the free edge of the slab and center-to-center spacing should be a minimum of twelve (12) bolt diameters.
 - I. Holes shall be clean and free from dust immediately prior to installation of the anchor.
- 1.18 TESTING AND INSPECTION REQUIREMENTS FOR EXPANSION AND EPOXY ANCHORS
- A. Post-installed anchors shall be tested in accordance with the provisions of CBC Section 1913A.7 by an accepted testing facility or Special Inspector. If any anchor fails testing, test all anchors of the same type, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency. If the anchors are used for the support and bracing of non-structural components (pipe, duct or conduit), the twenty (20) shall be only those anchors installed by the same trade. Refer to 1.19G.8 on the Test Values Table (this Section) for acceptance/failure criteria.
 - B. Structural Applications: Tension test all expansion-type anchors. Expansion-type anchors shall not be used as hold-down bolts. When used for sill plate bolting application 10% of the anchors shall be tension tested.
 - C. Non-Structural Applications: Tension test 50% or alternate bolts including at least one-half the anchors in each group, shall be tension tested. in a group. Nonstructural may include such applications as equipment anchorage.

- D. Tension testing shall be done in the presence of the project inspector and a report of the test results shall be submitted to DSA. If any anchors fail the tension-testing requirements, the additional testing requirements shall be acceptable to DSA.. The requirements shall also apply to bolts or anchors set in concrete with chemical (adhesives) if the long-term curability and stability of the chemical material and its resistance to loss of strength and chemical change at elevated temperatures are established to the satisfaction of the DSA.
- E. Expansion Type Anchors Setting Verification:
1. Torque-Controlled Anchors: Following attainment of 10% of the required torque, torque-controlled anchors shall not require more than six (6) additional complete turns of the nut during installation to achieve the manufacturer's specified installation torque. The extent of bolt projection after installation shall be measured to confirm that this requirement has been met.
 2. Displacement-Controlled Anchors: The position of the plug in the anchor shell shall be checked with the manufacturer-supplied installation tool or other appropriate device. The position of the plug shall conform to the manufacturer's specifications.
- F. Testing for Expansion-Type Anchors: The test load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, calibrated spring loaded devices, or a calibrated torque wrench. Displacement-Controlled anchors such as drop-in shall not be tested using a torque wrench. Required test loads may be determined by either of the following methods:
1. Twice the allowance tension load as determined in Article 1.18., or;
 2. Tension or torque test values from the table and procedures below.
 3. Anchors tested with a hydraulic jack should exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut. Anchors tested with a calibrated torque wrench must attain the specified torque within ½ turn of the nut.
- G. Test Values: Conform to the following table for either Hardrock or Lightweight Concrete and Masonry:
1. All anchor bolts of the expansion type installed in concrete shall be one of the following or equal:
 - a. ITW Red Head-Wedge Anchor-ICC/ES ESR-2427
 - b. Hilti, Inc. - Qwik Bolt TZ - Wedge Anchor-ICC/ES ESR-1917
 - c. Simpson - Strong Bolt - Wedge Bolt - Wedge Anchor-ICC/ES ESR-3037

Minimum Test Values - Normal Weight or Lightweight Concrete

	ANCHOR	WEDGE	
Dia(in)	Tension Load(lbs)	Torque(ft-lbs)	Embedment(in)
-	-	-	-
3/8	1105	25	2
1/2	2420	40	3-1/4
5/8	4015	60	4
3/4	4690	110	4-3/4
 2. All anchor bolts of expansion type installed in grout filled masonry shall be one of the following or equal:
 - a. Hilti, Inc - Kwik Bolt III-Wedge Anchor-ICC/ES NO.1385
 - b. Simpson-Wedge All-Wedge Anchor-ICC/ES NO. 1396
 3. Anchor diameter refers to the thread size for the WEDGE ANCHORS.

4. Reaction loads from test fixtures may be applied close to the anchor being tested, provided the anchor is not restrained from withdrawing by the fixture(s).
5. Test equipment (including torque wrenches) shall be calibrated by an approved testing laboratory in accordance with standard recognized procedures.
6. The following criteria apply for the acceptance of installed anchors:
 - a. Hydraulic Ram Method: The anchor shall have no observable movement at the applicable test load. For wedge and sleeve anchors, a practical way to determine observable movement is that the washer under the nut becomes loose
 - b. Torque Wrench Method: The applicable test torque must be reached within the following limit for wedge type:
 - 1) Wedge or Sleeve type: One-half (1/2) turn of the nut.
 - 2) One-quarter (1/4) turn of the nut for the 3/8 inch sleeve anchor only.
7. Testing shall occur within 24 hours after installation.
8. If the manufacturer's recommendation installation torque is less than the test torque listed in the table above, the manufacturer's installation torque shall be used in lieu of the tabulated values.

1.19 EPOXY-TYPE (ADHESIVE) ANCHORS AND SCREW-TYPE ANCHORS

- A. Epoxy-type (adhesive) anchors shall be tension tested per Section 1913A.7 . The tension test load shall equal twice the allowable load for the specific location of the anchor to be tested (i.e., accounting for edge distance) or 80% of the yield strength of the bolt ($0.8A_bF_y$), whichever is less. The test procedures for expansion-type anchors in the attached table shall also be used for epoxy-type (adhesive) anchors. Torque testing of epoxy-type (adhesive) anchors is not permitted.
- B. Where epoxy-type (adhesive) anchors are used as shear dowels across cold joints in slabs on grade and the slab is not part of the structural system, testing of those dowels is not required.
- C. Anchors shall exhibit no discernible movement during the tension test.
- D. Screw Anchors: The fastener is produced from hardened steel with threads, similar in appearance to a lag bolt. Screw anchors may be used, provided the allowable shear and tension loads are determined in accordance with the following:
 1. The allowable values listed in an ICC ES Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC 106, latest revisions, including the seismic qualification tests of AC106 Section 4.6.
 2. Welding to these anchors is not permitted.
 3. Screw anchors may be used to attach components, such as equipment, mechanical vibration isolators or snubbers, to structural (reinforced) concrete, or for sill bolting applications. All screw anchors installed through a wood sill plate requires a plate washer in conformance with Section 2308.6.
 4. The use of screw anchors is not permitted in overhead applications or for discrete hold down forces, such as shear walls.
 5. Masonry Anchors: 1/4" diameter, Tapcon with Advance Threadform Technology, heat-treated steel, by Illinois Tool Works/Buildex, ICC-ESR-1671. Slotted Hex Washer Head.

- E. Screw-type anchors shall be torque tested in accordance with the testing procedures in Test Values Table and procedures herein.
- F. Screw-type anchors: Simpson Strong-Tie Titen-HD concrete anchor, 3/8, 1/2 and 3/4 inch diameter, ICC ESR-2713, by Simpson Strong-Tie, Pleasanton, CA or equal with ICC report number.
- G. Screw-type anchors: Simpson Strong-Tie Titen-HD grout-filled CMU anchor, 3/8, 1/2, 5/8, and 3/4 inch diameter, ICC ESR-1056, by Simpson Strong-Tie, Pleasanton, CA or equal with ICC report number.

1.20 POWDER ACTUATED FASTENERS

- A. Powder-Actuated Fasteners: Powder-actuated fasteners (shot pins) are not addressed by Chapter 1908A1.1 of CBC. Powder-actuated fasteners may be used for limited application provided the allowable shear and tension loads are determined in accordance with the following:
 - 1. The allowable values listed in an ICC ES Evaluation Services Report, with special inspection, may be used for allowable stress design, provided the report states that the anchors were tested in accordance with AC 70, latest revision. Powder-actuated fasteners may be used for hanging metal suspension systems for lay-in panel ceilings and for the attachment of metal track in conjunction with non-bearing partitions. The use of powder-actuated fasteners for other applications shall be subject to review and approval of DSA.
- B. Powder actuated fasteners (Shot Pins): Installer shall utilize tools recommended by the manufacture in compliance with the ICC code reports. Pins shall have a minimum diameter of 0.145 inch and be installed to conform to the load requirements of this Section and:
 - 1. Tables 1 (driven into steel), 2 (driven into concrete), and 4 (driven into Structural. lightweight concrete) of ICC ESR-1663, Hilti or
 - 2. Table 1 or 3 (driven into concrete), 2 (driven into steel), 5 (driven into structural lightweight concrete), and 6 (driven in hollow concrete masonry units) of ICC ESR-2138, Simpson Strong-Tie powder-actuated fasteners or
 - 3. Table 1 and 2 (driven into concrete), 3 (driven into structural lightweight concrete), 4 (driven into hollow concrete masonry units), 5 (driven into steel) of ICC ESR-2811, Simpson Strong-Tie gas-actuated fasteners or equal with ICC report.
- C. Allowable Loads: Limited to 100 lbs. maximum or 80% of ICC approved values whichever is less. Testing required.
- D. Use of Powder actuated fasteners for tension loads is limited to support of minor loads such as suspended acoustical ceilings, ductwork and conduit. Permissible Loads for Ceiling Clip Assembly:
 - 1. Normal-Weight Concrete: Ceiling Clip Assembly Hilti X-CW, minimum 0.138" diameter, minimum penetration 1-1/8". Allowable Loads: 210 lbs. tension listed in ICC Report: ICC ESR 2184: 4000 psi Concrete Compressive Strength.
 - a. Type X-CW X-C 32 KWIK, by Hilti, Inc., Tulsa, OK, or equal.
 - 2. Use manufacture's drill bits and recommended tools.

- E. Permissible Loads for Sills. Light gage steel and Interior Wood Plate Anchorages:
 - 1. Low Velocity Power-Driven Fasteners: normal-weight concrete: Hilti DS and X-CR (stainless steel for exterior applications), 0.177" , 0.145 for X-CR, shank diameter with washers, ICC-ESR Report ER-1663, Table 2. Exterior or Perimeter Sill and Interior Plate Anchorages.
 - 2. Low Velocity Power-Driven Fasteners: normal-weight concrete: Simpson PDPWL-300, 3 inches long, 0.300 inch head diameter and 0.145 inch shank diameter with washer, ICC ESR-2138, Table 1 or 4. Exterior or Perimeter Sill and Interior Plate Anchorages.

1.21 REQUIRED TESTING FOR POWDER ACTUATED FASTENERS

- A. Testing: Operator, tool and fastener shall be pre-qualified by the Project Inspector.
 - 1. Tools shall conform to ANSI A10.3 safety requirements for Powder Actuated Fastening Systems and to all OSHA requirements.
 - 2. Manufacturer's representative shall provide safety training for all installation personnel and provide powder actuated tool operator certification in accordance with OSHA requirements.
- B. The Project Inspector shall observe the testing of the first 10 fastener installations.
- C. A test pullout load of not less than twice the design load or 200 lbs., whichever is greater, shall be applied to the fastener in such a manner as not to resist the spalling tendency of concrete in which the fastener is imbedded. Thereafter, random tests under the Project Inspector's supervision shall be made of approximately 1 in 10 fasteners.
- D. Should failure occur on any fastener tested, all installations shall be tested until twenty consecutive fasteners pass, then resume the initial testing frequency.

1.22 INSTALLATION

- A. When installing drilled-in anchors or powder driven pins in reinforced concrete, use care and caution to avoid cutting or damaging reinforcing bars. When required by the Architect, locate the reinforcing by using a non-destructive method prior to installation. Exercise extreme care and caution to avoid cutting or damaging reinforcing during installation. Maintain a minimum clearance of one inch between the reinforcing and the anchor and/or pin.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 ATTACHMENTS

- A. Form DSA-103, Statement of Structural Tests and Inspections.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, water and sanitary facilities.
- B. Temporary Controls: Barriers, enclosures, fencing, protection of Work and security.
- C. Construction Facilities: parking, progress cleaning, and field office trailer.
- D. Special Controls: Noise Control.
- E. Comply with Title 24, Part 9, California Fire Code, Chapter 33 Fire Safety During Construction and Demolition, during all Phases of project.
- F. INTERIM LIFE SAFETY MEASURES (ILSM) requirements in this Section.

1.02 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Coordinate location of staging area with the District and Program Manager.

1.03 TEMPORARY ELECTRICITY

- A. Provide temporary electrical service suitable to conduct construction operations.
- B. Connect to existing power service. Power consumption shall not disrupt District's need for continuous service.
- C. Contractor shall pay cost of energy used. Exercise measures to conserve energy. Contractor to cooperate with District in ascertaining prorated cost of energy used for his portion of Work.
- D. Provide power outlets for construction operations with branch wiring and distribution boxes located where needed. Provide flexible power cords as required.
- E. Provide feeder switch at source distribution equipment.
- F. Permanent existing convenience receptacles may not be utilized during construction.

1.04 TEMPORARY LIGHTING

- A. Provide and maintain adequate lighting for construction operations.

- B. Maintain lighting and provide routine repairs.
- C. Permanent building lighting may not be utilized during construction.

1.05 TEMPORARY HEAT

- A. Provide heating devices and heat as required to maintain specified conditions for construction operations.
- B. Contractor shall pay cost of energy used. Exercise measures to conserve energy.

1.06 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials to dissipate humidity and noxious fumes and to prevent accumulation of dust, fumes, vapors or gases.

1.07 TELEPHONE SERVICE

- A. Provide, maintain and pay for two separate telephone service lines and telephone service to field office and Project Inspector's field office at time of project mobilization. Project Inspector's telephone shall be equipped with exterior, clearly audible bell.
- B. Provide "Fax" facility at worksite.
- C. Provide answering machine.
- D. Provide, maintain, and pay for copy machine with 11 by 17 inch capability.

1.08 TEMPORARY WATER SERVICE

- A. Provide for suitable quality water service. Connect to existing water source for construction operations.
- B. Contractor shall pay cost of water used. Exercise measures to conserve water.
- C. Extend branch piping with outlets located so water is available by hose with threaded connections.

1.09 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Existing facilities shall not be used.

1.10 TEMPORARY FIRE PROTECTION

- A. Provide fire protection during construction according to CFC Chapter 33, including but not limited to fire extinguisher requirements and exit access requirements.
- B. Conform to Title 24, Part 9, California Fire Code, Chapter 33, , Fire Safety During Construction/Demolition.

- C. Maintain access to fire hydrants, free of obstructions. Where required by local fire authority, provide and maintain a 26 foot wide fire apparatus access road.

1.11 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades required by governing authority for public rights-of-way and for public access to existing facilities.
- C. Provide protection for plant life designated to remain. Replace damaged plant life.
- D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.
- E. Provide steel trench plates, orange mesh fencing, construction site marker and other protective means to keep site and users, District's personnel, visitors and students safe, protected, and separated from ongoing construction operations. Provide temporary access at all paths of travel. Yellow warning tape is not acceptable means of separation and protection. At all open trenching operations, enclose entire trenching operation area including stockpiled backfill within orange mesh construction fencing. Provide steel trench plate "bridges" at all walkways.

1.12 FENCING FOR CONSTRUCTION OPERATIONS

- A. Construction: Commercial grade chain link fence, top and bottom knuckled selvage (closed end).
 - 1. Provide screen full height of fence, 1-3/4 inch mesh, 11 gauge, woven open mesh 100% polypropylene with 78 percent wind break, reinforced tape at grommets at 18 inches centers at perimeter, attach screen to chain link fence with 11 gauge hog rings by Roxford Fordell, Los Angeles, CA.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.
- C. Submit detailed fencing and construction traffic plan for review and approval by Project Manager.
- D. At completion of project repair concrete or A.C. substrate, fill holes to match existing materials flush with adjacent surface.

1.13 STAGING AREAS

- A. Coordinate with Project Manager for location, extent and type of construction staging area.

1.14 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 hardware and locks.

1.15 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as required 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: Wood framing , plywood or gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces, translucent or opaque as directed by District.
- C. Paint surfaces exposed to view from District-occupied areas where required for rigid wall construction.

1.16 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual Specification Sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.
- C. Provide protective coverings at walls, projections, jambs, sills and openings. Provide protective and removal coverings for metal finishes intended to be exposed.
- D. Protect finished floors and other surfaces from traffic, dirt, wear, damage or movement of heavy objects by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces.
- F. Prohibit traffic from landscaped areas.

1.17 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 and Campus Police.
- C. Within 48 hour period, replace or repair, to Architect's satisfaction, all surfaces or items damaged by graffiti during course of construction.
- D. Where security or fire detection systems are disabled for any reason, including where District/College has given approval for such system shutdown, provide fire watch or security guard service as directed by District/College at no additional cost to District.

1.18 ACCESS

- A. Provide and maintain access to fire hydrants, free of obstructions. Where required by local fire authority, provide and maintain a 26 foot wide fire apparatus access road.
- B. Provide means of removing mud from vehicle wheels before entering streets.
- C. Designated existing on-site roads may be used for construction traffic.
- D. Where construction traffic occurs when students and staff are on campus , provide "spotter" responsible for leading construction traffic through site areas.
- E. Route construction equipment, trucks, and similar vehicles via existing public streets to and from site as approved by governing authorities.

1.19 PARKING

- A. Arrange for temporary parking areas to accommodate construction personnel.
- B. When site space is not adequate, provide additional off-site parking.

1.20 PROGRESS CLEANING

- A. Refer to Section 01 70 00 Execution Requirements and the requirements of this Section.
- B. Maintain areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.
- C. Remove debris and rubbish from closed or remote spaces, prior to enclosing space.
- D. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust. Clean substrate; remove dirt, oil, grease, construction markings, and foreign matter that could adversely affect surface finish appearance or performance.
- E. Remove waste materials, debris and rubbish from site weekly and dispose off-site.
- F. Maintain public streets free of mud, dust and debris and as required by jurisdictional authority.

1.21 PROJECT SIGNAGE

- A. Provide project sign, as designed by Project Manager. Fabricate using exterior-grade plywood and wood frame construction, acrylic painted with exhibit lettering by professional sign painter.
 - 1. List title of Project, names of College District Architect and Contractor.
 - 2. Erect on site at locations established by mutual agreement of District, Architect and Contractor.

- B. Except for signs required by law, no other signs will be permitted without express written permission from District. Signs required by law may not obscure any of the banners.

1.22 FIELD OFFICE TRAILER

- A. Field Office Trailer: Provide field office trailer, weather tight with lighting, electrical outlets, communications capabilities, heating, cooling and ventilating equipment and equipped to adequately conduct meetings for construction operations, minimum size; 480 sq. ft. Provide chemical toilet(s) portable chemical toilet facilities. Quantity of portable chemical toilet facilities shall be based on total number of workers and shall be in accordance with CAL/OSHA standards. .
 - 1. In SAME Field Office trailer provide separate private office similarly equipped and furnished with desk, 2 drawer file cabinet, a table and two chairs for use by Project Inspector, District and Architect including plan rack suitable for 30 by 42 inch drawings, minimum size 120 square feet. Inspector's office must be lockable and have direct access to outside, provide private telephone line and access to the Internet to inspector's office.
- B. Cost of use permits, occupancy permits and related fees, if any required by Governing Authorities for temporary construction facilities, shall be paid by Contractor.
- C. Provide 4 by 8 feet conference table, 6 conference chairs and 3 by 6 feet white markerboard at conference room.
- D. Install no closer than 45 feet from project buildings in accordance with NFPA 241.
- E. Maintain facility until Substantial Completion of entire project. Remove within 1 week of Substantial Completion.
- F. Provide property insurance and protection.

1.23 REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

- A. Remove temporary above grade or buried utilities, equipment, facilities, materials prior to Certified Completion inspection.
- B. Remove temporary underground or overhead installations.
- C. Clean and repair damage caused by installation or use of temporary Work.
- D. Restore permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.24 RELOCATION OF UTILITIES

- A. Contractor shall not have responsibility of timely removal, relocation or protection of public utility facilities that are not identified by District in Drawings and Specifications, in accordance with California Government Code 4215. District shall compensate Contractor for costs of locating and repairing damage not due to failure of Contractor to exercise reasonable care in removing and relocating such public utility facilities. If Contractor, while performing Contract, discovers public utility facilities not identified by District in Contract Drawings or Specifications, he shall immediately notify District and utility in writing. Contractor shall not be assessed liquidated damages for delay when delay was caused by failure of District to provide for relocation for utility facilities.

1.25 WATER CONTROL

- A. Do not permit surface, rainwater or subsurface water or other liquids to accumulate in or about premises and vicinity thereof. Should such conditions be encountered or develop, control water or other liquid shall be suitably disposed of by means of temporary pumps, piping, drainage lines, troughs, ditches, dams or other methods as reviewed by the Program Manager and the Architect and approved by authority having jurisdiction.

1.26 NOISE CONTROL

- A. Avoid excessive noise where adjacent College's functions may be detrimentally affected.
- B. Refer to requirements in Section 01 57 20, Control of Construction Noise. Noise Control Plan: Submit Noise Control Plan after the Contract is awarded, prior to the commencement of the work, Contractor shall meet with the District to discuss the proposed Noise Control Plan and to develop mutual understanding relative to details of the Plan.
 - 1. The Noise Control Plan shall comply with the constraints set forth by the District.
 - 2. Submit a description of the instruments to be used in monitoring noise.
 - 3. Show the areas and boundaries where noisy work will occur.
 - 4. Approval of the Contractor's Noise Control Plan will not relieve the Contractor of responsibility for proper and continuing control of noise throughout the project site.

1.27 POLLUTION CONTROL

- A. 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.
- B. Burning of refuse, debris or other materials will not be permitted on Site.
- C. Comply with regulatory requirements and anti-pollution ordinances during course of construction and disposal operations.

1.28 WASTE DISPOSAL FACILITIES

- A. Comply with requirements of Authorities Having Jurisdiction. Remove loose refuse and dispose off site legally.
- B. Provide waste-collection containers in sizes adequate to handle waste from construction operations.
- C. Provide and maintain trash bins on the Project site. Trash bins shall be serviced on an as needed basis or as designated by the District and College.
- D. Free Fall Maximum: 8 ft. Provide enclosed waste CHUTES for higher fall.
 - 1. Provide disposals sufficiently sized to prevent debris from scattering around areas.
 - 2. Use support systems, intake hoppers, protective liners and durable non-breakable chutes. Max-Access Inc., Houston, TX, Chutes International, White Plains, MD or equal.
 - 3. When using demolition chutes, chute opening must be sealed when not in use. Chute and dumpster shall be sprayed with water to maintain dust control.
 - 4. Do not use District's disposal system.

1.29 PROTECTION OF EXISTING FACILITIES AND SITEWORK

- A. Provide site plan of proposed route of construction equipment for approval by District. Coordinate with the Program Manager, District, and College to develop a site plan which will be part of the Contract Documents.
- B. Use caution to minimize disturbance and damage to existing landscaped areas and sitework.
- C. Protect sidewalks, curbs, entry areas and utilities.
- D. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) and irrigation on or adjacent to the work site, which are not to be removed or are not part of the scope of work, and which do not unreasonably interfere with the work required under this contract.
- E. Protect from damage all existing improvements and utilities at or near the work site , the locations of which are made known to or should be known by the Contractor. Repair any damage to those facilities, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work.
- F. Repair landscaped areas, irrigation and sidewalks and any other damaged facilities where trucks, erection equipment or other construction equipment was used during construction. Repair damaged areas to match existing construction to satisfaction of the District and College, and at no additional cost to the District.
- G. The contractor is responsible for cleaning up nails, and all construction debris to protect against personal or vehicular harm.

1.30 CONTRACTOR CONDUCT AND DRESS CODE

- A. Contractor's and subcontractors' personnel shall observe and abide by District and College requirements concerning appropriate conduct, loud noise (unrelated to construction activities) and dress requirements for a safe and un-disturbing work place. Conduct work activities in a professional manner at all times.
- B. Dress Code requirements: contractor's personnel shall wear traditional work attire or uniforms without logos, graphics or wording detrimental to College environment; unless logos, graphics or wording are for business identification purposes.
- C. Contractors and subcontractors shall wear orange safety vests along with other required safety attire including hard hats and safety glasses.
- D. Identification badges issued by the District shall be worn at all times, worn on the left side shirt-pocket area, displayed in full view and not concealed.
- E. No radios permitted on the job site.
- F. District/Colleger reserves the right to remove any person(s) not observing conduct and dress requirements specified herein.
- G. Animals: Contractors' and workers' pets or animals of any kind are not permitted on the Campus, including being retained in a vehicle.

1.31 MOBILIZATION AND DEMOBILIZATION

- A. Coordinate with the Program Manager, the District, and the College.
- B. The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.
- C. Mobilization: Equipment and Material; Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable.
- D. Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.

- E. This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.
- F. Payment: Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.
- G. Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

1.32 INTERIM LIFE SAFETY MEASURES (ILSM)

- A. Coordinate with the project's Program Manager, the District, and the Sheriff on site.
- B. ILSM must be implemented in, or adjacent to, all construction areas within the scope of work of this contract. ILSM apply to all construction personnel, including personnel of the General Contractor, Sub-contractors, Vendors, Suppliers, and any other personnel under the supervision and coordination of the General Contractor. ILSM shall be continuously enforced by the Contractor throughout the duration of the Contract.
- C. The Contractor shall ensure that exits provide free and un-obstructive egress.
 - 1. Unless provided elsewhere, the Contractor shall provide a Construction Egress Plan, showing temporary barricades, egress paths, and exits from, around, and (if necessary through) the construction area. Temporary exits shown on the Plan must be identified with exit signs approved by the local authority having jurisdiction.
- D. The Contractor shall ensure free and unobstructed access to emergency departments and services for emergency forces.
- E. The Contractor shall ensure that fire alarm, detection, and suppression systems, as well as structural and compartmentation features of fire safety outside the construction area are not impaired or compromised.
 - 1. When the existing fire systems or fire safety features outside the construction area must be impaired or compromised a temporary but equivalent system or feature shall be provided. All temporary systems must be tested and inspected monthly.
 - 2. In lieu of temporary systems or features, the Contractor may provide a Fire Watch as described in above and other measures as required by the authority having jurisdiction.

- F. The Contractor shall ensure that temporary construction barricades and barricade doors are smoke tight and made of non-combustible or limited combustible materials that will not contribute to the development of smoke or fire.
- G. The Contractor shall provide additional fire-fighting equipment and user-training for his personnel.
- H. The Contractor shall ensure the prohibition of smoking by his personnel.
- I. The Contractor shall develop and enforce storage and debris-removal practices that reduce the flammable and combustible fire load of the construction area to the lowest level necessary for daily operations.
- J. The Contractor shall conduct a minimum of one fire drill every month throughout the duration of the project.
- K. The Contractor shall provide daily hazard surveillance of the construction area with special attention to excavations, construction storage, and field offices.
- L. The Contractor shall track all safety occurrences and provide a log to the Program Manager each week.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials for temporary work may be new or used.
 - 1. Use materials that are adequate in capacity for the required use and loads.
 - 2. Do not use materials that would create unsafe conditions.
 - 3. Do not violate requirements of authorities having jurisdiction.
- B. Electrical Materials
 - 1. Electrical materials should be appropriate for the project and meet all Code requirements. Special project needs for this section should be reviewed with the Project Manager, the District and the College.
 - 2. Light Fixtures and Lamps: Medium-base, rubber pigtail, type lamp sockets or porcelain lampholders furnish with boxes, and lamps.
 - 3. Conductors: insulated copper or aluminum, with phase conductor insulation rated for the circuit voltage, and insulation or jacketing suitable for the conditions, and branch circuit conductors - No. 12 AWG minimum size, except No. 10 AWG where length of branch circuit exceeds 100 feet.
- C. Mechanical Materials
 - 1. Portable Equipment may be new or used, temporary units that will not damage construction materials or processes, that will not create unhealthy conditions for workers, and that can be operated with approval from the authorities having jurisdiction.
 - 2. Fixed Equipment may be new or used, temporary or permanent, devices including any heat generating or cooling equipment that can be operated in a safe manner and with approval from the authorities having jurisdiction.
 - 3. Fuel. Use only devices that burn either natural gas or fuel oil.

- a. Store fuel oil in portable tanks with a 60 gallon maximum capacity, located on the same level as the devices, and equipped with fills and vents outside the enclosed space.
- b. Locate the tanks a minimum of 10 feet from heating devices. Label tanks with proper type of fuel.

PART 3 - EXECUTION

3.01 REMOVAL

- A. Remove all temporary control measures in accordance with regulatory requirements at completion of construction.

END OF SECTION

SECTION 01 55 00

VEHICULAR ACCESS AND PARKING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Signs, Signals and devices.
- B. Construction Parking Control.
- C. Flagmen
- D. Flares and Lights.
- E. Haul Routes.
- F. Traffic Signs and Signals.
- G. Removal

1.02 COORDINATION

- A. Coordinate this section with all of the following:
 - 1. Program Manager
 - 2. Grossmont Cuyamaca Community College District
 - 3. Sheriff
 - 4. Cuyamaca College
 - 5. CAPS Officer

1.03 SIGNS, SIGNALS AND DEVICES

- A. Post-Mounted and Wall-Mounted Traffic Control and Informational Signs as required to maintain adequate standards of safety and control of vehicular movement on and off construction site.
- B. Traffic Control Signals: As approved by local jurisdictions.
- C. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
- D. Flagmen Equipment: As approved by local jurisdictions.

1.04 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. Maintain vehicular access to and through parking areas.

- C. Prevent parking on or adjacent to access roads or in non-designated areas.

1.05 FLAGMEN

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

1.06 FLARES AND LIGHTS

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

1.07 HAUL ROUTES

- A. Consult with authority having jurisdiction in establishing 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.
- D. Consult with District to establish construction traffic haul route [on existing campus].

1.08 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. Install and operate traffic control devices as are necessary to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations.
- C. Relocate as Work progresses to maintain effective traffic control.

1.09 REMOVAL

- A. Remove equipment and devices when no longer required.
- B. Repair damage caused by installation.
- C. Remove post settings to full depth.

HMC Architects

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 57 20

CONTROL OF CONSTRUCTION NOISE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section specifies the control of noise arising from construction operations and associated activities. Noise control measures specified are an obligation of the Contractor with the costs included within the various contract items of work.
- B. Construction noise shall be addressed in Division 01.

1.02 QUALITY ASSURANCE

- A. Establish and maintain quality assurance program for the control of noise.
- B. Design team shall coordinate with Program Manager and District to identify specific construction noise control mitigation measures.

1.03 SUBMITTALS

- A. Noise Control Plan: After the contract is awarded, prior to the commencement of the Work, the Contractor shall meet with the Program Manager and the College to discuss the proposed Noise Control Plan and to develop mutual understanding relative to details of the Plan.
 - 1. The Noise Control Plan shall comply with the constraints set forth by the District, and be in compliance with the noise control regulations of the District and the City of El Cajon.
 - a. Include time duration of any noise and the impact of the noise.
 - 2. Submit a description of the instruments to be used in monitoring noise.
 - 3. Show the areas and boundaries where noisy work will occur.
 - 4. Approval of the Contractor's Noise Control Plan will not relieve the Contractor of responsibility for proper and continuing control of noise throughout the project site.

1.04 NOISE CONTROL

- A. General: Take every practicable precaution and action to eliminate or minimize noise emanating from the construction operations.
- B. Timing: Perform noise-producing work in less-sensitive hours of the day or week as directed by the District.
- C. Constraints: Control and abate noise produced by the Work at or below the decibel levels and within the time periods specified.

1. Repetitive, high level impact noise will be permitted only between 7:00 a.m. and 4:00 p.m. Normal construction time specified in Section 01 10 00 Summary of Work unless otherwise permitted by the District. Repetitive impact noise on the property shall not exceed the following dB limitations:
2. Time Duration of Impact Noise Sound Level in dB

More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75
3. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary to comply with the requirements specified, and comply with the following:
 - a. Maximum permissible construction equipment noise levels within 50 feet of any building on the premises shall be 75 decibels.
 - b. Provide shields or other physical barriers to restrict the transmission of noise.
 - c. Provide soundproof housings or enclosures for noise-producing machinery.
 - d. Use intake and exhaust mufflers on internal combustion engines that are maintained to have equipment perform below noise levels specified.
 - e. Line hoppers and bins with sound deadening material.
 - f. Conduct truck loading, unloading and hauling operations so that noise is kept to a minimum.
4. At least once every five successive working days while work is being performed, above 55 dBA noise level, measure sound level for noise exposure due to the construction. Measure noise exposure at the property line or 50 feet from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, measurements may be taken three to six feet in front of any building face. Submit the recorded information to the Architect noting any problems and the alternatives for mitigating actions.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Products
- B. Transportation and handling.
- C. Storage and protection.
- D. Product options.
- E. Substitutions

1.02 PRODUCTS

- A. Product: means new material, machinery, components, equipment, fixtures and systems forming Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of Work. Products may also include existing materials or components required for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- C. Provide interchangeable components from the same manufacturer.

1.03 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that products comply with requirements, titles are correct and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

1.04 STORAGE AND PROTECTION

- A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.
- B. For exterior storage of fabricated products, place on sloped supports, above ground and protect as necessary to prevent deterioration or damage to the product.

- C. When approved by the District, provide off-site storage and protection in a bonded warehouse approved by District when site does not permit on-site storage or protection at no cost to District.
- D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- E. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement or damage.
- G. Arrange storage of products to permit access for inspection. Periodically inspect to ensure products are undamaged and are maintained under specified conditions.

1.05 PRODUCT OPTIONS

- A. Where products are specified by reference standards or by description only, provide products meeting those standards or that description, made by a manufacturer acceptable to Architect.
- B. Where products are specified by naming one or more manufacturers, provide products of one of the named manufacturers that meets or exceeds specifications.
- C. Where any specific article, device, equipment, product, material, fixture, patented process, form, method, or type of construction is indicated or specified by name, make, trade name, or catalog number, whether with or without the phrase "or equal," such specification shall be deemed to establish the minimum qualities of function, dimension, appearance, and performance (collectively the Basis of Design) for that material, process, or article. Such specification shall be deemed to be followed by the phrase "or equal."
- D. If a named product, or named manufacturer's equivalent product does not fully meet the specification, that manufacturer shall provide a custom or modified product to meet the specification.
- E. Where expressly noted "no substitutions" in individual Sections, no product options are permitted.
- F. When the phrase "or equal" is used or implied, it shall mean "an equivalent product, approved by the Architect in accordance with the requirements of this Section."
- G. Products, proposed as substitutions, shall conform to requirements listed in the respective Section of this Manual and have at least 10 successful installations in commercial projects similar in scale and complexity to those required for this Project that have been in service for minimum of 5 years and remain in satisfactory condition.

1.06 SUBSTITUTIONS

- A. Manufacturers and products listed in Specifications form basis for design and quality intended. Bidders may propose substitutions of equal design and quality and must be accompanied by completed Request Form included at end of this Section, other forms not permitted. Submit separate form for each proposed substitution.
 - 1. Substitution requests, if any, shall be submitted to Architect a minimum of 9 calendar days before Bid Opening. Architect will issue acceptance or rejection of request.
- B. Substitutions must clearly be in District's best interest because of quality, cost, performance, conformity to code requirements or availability. Architect will make decision as to acceptance of proposed substitution.
 - 1. Submittal of proposed substitutions shall be made only by Prime Contractor(s). Architect will not review direct submittal by manufacturers, suppliers or subcontractors.
 - 2. Burden of proof as to equality of any material, process or article shall rest with Contractor. Provision authorizing submissions of "or equal" justification data shall not in any way authorize an extension of time for performance of this Contract.
 - 3. Substitutions shall, without exception, be manufactured of same basic materials and comply with or exceed all Specification requirements of dimension, function, structure and appearance, without deviation. Provide itemized comparison of quality and performance.
 - 4. Use of approved substitutions shall in no way relieve Contractor from responsibility for compliance with Contract Documents after installation. Contractor shall assume all extra costs caused by use of approved substitute materials.
 - 5. Statement indicating why specified material or product cannot be provided.
 - 6. Coordination information, including list of changes or modifications needed to other parts of Work and to construction performed by District and separate contractors that will be necessary to accommodate proposed substitution.
 - 7. Detailed side by side comparison of significant qualities of proposed substitution with those of the Work specified. Mark clearly affected specification Section for any differences from item specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect and specific features and requirements indicated.
 - 8. Product Data Samples, including drawings and descriptions of products and fabrication and installation procedures.
 - 9. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and District.
 - 10. Material test reports from qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - 11. Cost information, including a proposal of change, if any, in the Contract Sum.
 - 12. Substitutions for specified product, brand or manufacture that have been submitted and disapproved by Architect shall not be resubmitted in any modified form.
 - 13. In case materials are substituted and installed without proper authorization, Contractor shall remove such materials and install those specified at his own expense.

14. Contractor shall determine effect approved substitutions will have on other portions of Work and so inform his subcontractors and employees of these effects.
 15. Acceptance of proposed substitution shall be determined solely by specifying Architect. The final decision shall be the Architect's in accordance with the General Conditions.
- C. Substitutions may be considered when product becomes unavailable through no fault of Contractor. Provide letter from manufacturer, on manufacturer's letterhead, stating lack of availability.
 - D. Unacceptable Substitutions: substitution requests initiated by late submittals that have caused materials to become unavailable due to delay in ordering and procurement will not be acceptable reason for substitutions.
 - E. Provide same warranty for substitution as for specified product.
 - F. Contractor shall pay costs for time required by Architect for review and for any redesign services associated with substitutions and for costs of re-approval by Regulatory Agencies.
 - G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request.
 - H. Each subcontractor is responsible for providing products and construction methods compatible with products and construction methods of other subcontractors. If dispute arises between subcontractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
 - I. Substitution Submittal Procedure: In accordance with Division 01, General Requirements for Administrative Requirements and this Section.
 - J. All Substitutions for any material, system or product that would otherwise be regulated by DSA shall be included in an Addendum or Form DSA-140, and shall be approved by DSA prior to fabrication or use. (CAC Section 4-338(c) and IR A-6)
- 1.07 DISTRICT-FURNISHED, DISTRICT-INSTALLED WORK (DFDI)
- A. Indicate in construction progress schedule District-furnish district-installed items and schedule time for installation. Provide notification to District not less than 30 days prior to scheduled installation for coordination.
 - B. Items indicated on Drawings as DFDI will be furnished by District and installed by District. Work indicated as DFDI will be performed under separate contract employees by District at its discretion. Where work of this Contract adjoins or conflicts with DFDI, work, Contractor shall cooperate with District and its employees in manner that will provide for reasonable and accurate completion of this Contract and work under separate contract.
 - C. DFDI Work shall be reviewed and coordinated with Program Manager, the District, and the College. These items will be noted in the Contract Documents as DFDI.

- D. Coordinate with OFOI work affecting this contract. Including verification and interfacing of this contract with OFOI work. Coordination shall include, but not to be limited to, provision of concealed backing or supporting construction, location of utilities and accessibility for installation or maintenance.

1.08 DISTRICT-FURNISHED, CONTRACTOR-INSTALLED WORK (DFCI)

- A. Indicate in the construction progress Schedule District-Furnish Contractor-Installed items and schedule time for their installation.
- B. Contractor shall verify exact sizes and services required for each item of equipment indicated on Drawings or in Project Manual as DFCI and shall obtain from District rough-in drawings, diagrams, setting templates and other necessary information to ensure proper mating of assemblies.
- C. Contractor shall receive at project site each item of equipment from District and from that time on shall assume full responsibility for items and equipment until one year from date of Certified Completion.
- D. Contractor shall give District 15 days prior notice of requirements for delivery to site of all DFCI equipment.
- E. Contractor shall be responsible for receiving DFCI items and equipment and shall uncrate, inspect and notify District in writing within 7 days of receiving said items or equipment of acceptance or rejection of items or equipment. District, after receiving notice, will take appropriate action to have items or equipment made acceptable for Contractor's use. Rejected items shall be carefully stored and protected from damage by Contractor until District takes appropriate action.
- F. Contractor shall be responsible for final placing, installation, connection, start-up, checking, testing and demonstrated satisfactory operation. District will provide names of manufacturer's representatives, who shall assist the Contractor in checking, testing and demonstrating equipment.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

END OF SECTION

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number: _____

To: HMC Architects, Inc. From: _____

Re: _____ Date: _____

Architect's Project Number: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____

Trade Name: _____

Attached data shall include: product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitutions will require for its proper installation, at no cost to the Owner.

The Undersigned Certifies:

- Proposed substitution has been fully investigated and determined shall be equal or superior in respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing and construction costs caused by the substitutions.
- Reason(s) why substitution is being submitted.
 - ☐ Specified product or material is not available. Explain in detail as attachment.
 - ☐ Cost savings to Owner. Indicate comparative cost analysis as attachment.
 - ☐ Other. Explain:

Submitted by _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

A/E's REVIEW AND ACTION

- ☐ Substitution Approved
- ☐ Substitution Rejected as marked below:
- ☐ Insufficient information submitted
 - ☐ Submitted late.
 - ☐ Information not clearly marked.
 - ☐ Full line product information (Binder not provided).
 - ☐ Does not meet performance / design requirements of Paragraph _____
 - ☐ Comparisons not properly identified on product data sheets.

Signed by: _____ Date: _____

Substantiating Data Required:

- | | |
|--|---|
| <input type="checkbox"/> Drawings | <input type="checkbox"/> Tests if required in individual sections |
| <input checked="" type="checkbox"/> Product Data | <input type="checkbox"/> Reports if required in individual sections |
| <input checked="" type="checkbox"/> Samples | <input type="checkbox"/> Other: _____ |

SECTION 01 70 00
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Field engineering and surveying.
- B. Requirements and limitations for cutting and patching of Work.
- C. Cleaning throughout construction period.
- D. Project Record Documents.
- E. Closeout procedures.
- F. Adjusting
- G. Operation and maintenance data.
- H. Warranty and Guarantee.
- I. Spare parts and maintenance materials.
- J. Instruction to District's personnel.

1.02 COORDINATION

- A. Coordinate Execution Requirements with the Program Manager, the District, and the College.

1.03 FIELD ENGINEERING QUALITY CONTROL

- A. Employ Land Surveyor registered in the State of California and acceptable to Architect.
- B. Submit name, address and telephone number of Surveyor before starting survey work.
- C. Maintain complete and accurate log of control and survey Work as it progresses.
- D. On completion of foundation walls, floor slabs and major site improvements, prepare a certified survey illustrating dimensions, locations, angles and elevations of construction.

1.04 SURVEY REFERENCE POINTS

- A. Contractor to locate and protect survey control and reference points.
- B. Control datum for survey is that established by District provided survey.

- C. Protect survey control points prior to starting site Work; preserve permanent reference points during construction.
- D. Promptly report to the Architect loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to the Architect.

1.05 SURVEY REQUIREMENTS

- A. Provide field engineering services. Use recognized engineering survey practices.
- B. Establish a minimum of two permanent 3-inch diameter brass plate benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data on Project Record Documents. Establish additional temporary bench marks at all floor levels.
- C. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means, make use of laser instrumentation. Contractor shall arrange and pay for Field Engineering and Staking.
 - 1. Site improvements including pavements; stakes for grading, fill placement; utility locations, slopes, invert elevations and batter boards.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
 - 4. Floor elevations of existing structures that relate to project.
 - 5. Partition layouts on rough floor as a guide to all trades.
- D. Periodically verify layouts by same means.

1.06 LAYOUT MARKINGS

- A. Layout markings shall not be made with xylene-based inks, paint, or dyes, or with other solvent-based products that may bleed through finishes.

1.07 EXISTING CONDITIONS

- A. Before beginning Work, investigate and verify existence and location of mechanical, drainage, and electrical systems and other construction affecting Work, including underground utilities.
 - 1. Before construction, survey and record points of connection of utility services.
 - 2. Locate invert elevation at points of connection to existing sanitary- and storm drain, water-service piping, and underground electrical services.
 - 3. Employ a utility service locator company to locate underground utilities.
 - 4. Verify District's Record Drawings.
 - 5. Furnish survey of existing utilities.

1.08 CUTTING AND PATCHING

- A. Where Work requires that particular existing building element such as partition, wall, paving, window, or similar element of existing building construction be removed, it is the intention of this Specification that such Work be part of the Demolition Section and not part of Cutting and Patching.
- B. New Work required to replace such removals is considered as part of separate sections of Specifications covering similar new construction.
- C. Where incidental cutting and patching is required for installation of a specific item or piece of equipment (including piping, ductwork, conduit, etc.), such cutting and patching is considered to be specified as part of that Section.
- D. Contractor shall verify and check areas to be cut and patched and shall coordinate Work of various trades involved.
- E. Where doubt exists as to size, location, or method of cutting concrete or any other structural element, including metal stud framing, Contractor shall contact Architect before proceeding.
- F. Where doubt exists, Contractor shall distinguish between "cutting and "demolition.
- G. Unless specifically indicated otherwise, existing Work cut, altered, or revised to accommodate new Work shall be patched to duplicate undisturbed adjacent finishes, colors, textures, and profiles. New Work in existing portions shall also be finished to match adjacent existing Work unless noted otherwise.
- H. Submit written request in advance of cutting or alteration which affects any of the following.
 - 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. Coordinated Drawings in accordance with Division 01, General Requirements (Section 01 30 00).
- I. Include in request:
 - 1. Identification of Project.
 - 2. Location and description of affected Work.
 - 3. Necessity for cutting or alteration.
 - 4. Description of proposed Work and products to be used.
 - 5. Alternatives to cutting and patching.
 - 6. Effect on Work of District or separate Contractor.
 - 7. Written permission of affected separate Contractor.
 - 8. Date and time Work will be executed.

1.09 QUALITY ASSURANCE - CLEANING

- A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.
- B. Codes and Standards: In addition to requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.
- C. For final cleaning, use only professional cleaning company experienced in commercial cleaning.

1.10 PAYMENT WITHHELD - CLEANING

- A. Architect reserves right to withhold certification of payment requests for failure on part of Contractor to regularly clean Project in conformance with Requirements of this Section.

1.11 CLOSEOUT PROCEDURES

- A. District Occupancy:
 - 1. Detail Closeout Procedures with specific requirements for this project.
 - 2. Conform to Part 1, Title 24, Section 4-336 CCR Requirements for Verified Reports and Closeout Procedures.
 - 3. In conjunction with Project Inspector, Contractor shall prepare list of items (Punchlist) to be completed or corrected. List may be developed by areas when approved by Architect.
 - 4. Within time specified in the Certificate for Substantial completion after receipt of list, Architect will inspect to determine status of completion.
 - 5. Should Architect determine that Work is not complete:
 - a. Architect will promptly notify Contractor in writing, giving reasons for his determination.
 - b. Contractor shall remedy deficiencies and notify Architect when Work is ready for re-inspection.
 - c. Architect will re-inspect Work.
 - 6. When Architect concurs that Work is substantially complete and ready for occupancy.
 - a. District will prepare the Notice of Completion accompanied by Contractor's list (Punchlist) of items to be completed or corrected as verified by Architect.
 - b. The Certified Notice of Completion will be submitted to the District and to Contractor for their written acceptance of responsibilities assigned to them in such notice.
 - c. Contractor shall provide consent by insurer for Partial or Beneficial Occupancy.
- B. Final Completion:
 - 1. Prepare and submit notice that Work is ready for final inspection and acceptance.
 - 2. Verify Work is complete.
 - 3. Clarify that:
 - a. Work has been inspected by all governing agencies and is in compliance with Contract Documents.

- b. Work has been completed in accordance with Contract Documents.
 - c. Equipment and systems have been tested as required and are operational.
 - d. Work is completed and ready for final inspection.
 - 4. Architect will make an inspection to verify status of completion.
 - 5. Should Architect determine Work is incomplete or defective:
 - a. Architect will promptly notify Contractor in writing, listing incomplete or defective Work.
 - b. Contractor shall remedy deficiencies promptly and notify Architect when ready for re-inspection.
 - 6. When Architect determines Work is acceptable under the Contract Documents, he will request Contractor to make closeout submittals.
 - C. Closeout Submittals include, but are not necessarily limited to:
 - 1. Project Record Documents.
 - 2. Operation and maintenance data for items so listed in pertinent Sections of these Specifications and for other items when so approved by Architect.
 - 3. Warranties and Guarantees.
 - 4. Keys and keying schedule.
 - 5. Spare parts, materials, extra stock to be turned over to District.
 - 6. Evidence of payment and release of Stop Notices , when requested by District.
 - 7. List of subcontractors, service organizations and principal vendors, including names, addresses and telephone numbers, where they may be contacted for emergency service at all times, including nights, weekends and holidays.
 - 8. Notification of insurer for completion of Project.
 - D. Final Payment:
 - 1. Submit Final Payment Request, showing all adjustments to Contract Sum.
 - 2. Retention will be released no sooner than 35 days after Notice of Completion has been recorded with County Recorder's Office.
- 1.12 ADJUSTING
- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- 1.13 PROJECT RECORD DOCUMENTS
- A. Record Documents: As-Built Drawings, Project Manual with Specifications including but not limited to the documents required herein.
 - B. District will provide one set of drawings and one copy of Project Manual for use during construction to record changes made during construction.
 - C. Record Documents: As-Built drawings and Project Manual, record in concise manner using industry-standard drafting techniques on drawings, on weekly basis all actual revisions to Work
 - 1. Changes made on Drawings, including Clarification Drawings.
 - 2. Changes made to Specifications.
 - 3. Changes made by Addenda.
 - 4. Changes made by Construction Change Directives/Instruction Bulletins, Architect's Supplemental Instructions, minor changes.
 - 5. Change Orders or other authorized Modifications to Contract.

6. Revisions made to shop drawings, product data and samples.
 - D. Store Record Documents separate from documents used for construction. Replace soiled or illegible documents.
 - E. Record information concurrent with construction progress.
 - F. Specifications: Legibly mark and record at each product Section description of actual products installed, including following:
 1. Manufacturer's name, trade name, product model and number and supplier.
 2. Authorized product substitutions or alternates utilized.
 3. Changes made by Addenda and Modifications.
 - G. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Measured depths of foundations in relation to finish first floor datum.
 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Identify drains and sewers by invert elevation.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of Work. Identify ducts, dampers, valves, access doors and control equipment wiring.
 4. Field changes of dimension and detail.
 5. Details not on original drawings.
 - H. Obtain Architect's signed certification that Record Documents have been fully updated prior to submitting monthly payment requests. Compliance is mandatory before payment will be made.
 - I. Submit Record Documents certified by Inspector to Architect with claim for final Application for Payment. Fully completed Record Documents are a prerequisite to final payment.
- 1.14 OPERATION AND MAINTENANCE DATA
- A. Submit six (6) sets prior to final inspection, bound in 8-1/2 by 11 inch text pages, in binders with durable covers. Include operation and maintenance data for all items for which submittals are requested in individual Sections of Specifications.
- 1.15 WARRANTY AND GUARANTEE
- A. Contractor, manufacturer's warranties and guarantees notwithstanding, warrants entire Work against defects in materials and workmanship for twelve (12) months from date of Certified Notice of Completion. Warranties and guarantees between Contractor and manufacturers and Contractor and suppliers shall not affect warranties or guarantees between Contractor and District. Refer to General and Supplementary Conditions for additional requirements.
 - B. Execute and assemble documents from subcontractors, suppliers and manufacturers.
 - C. Submit prior to final Application for Payment.

- D. For items of Work delayed beyond date of Notice of Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of Guarantee Period.

1.16 WARRANTIES - FORM OF SUBMITTALS

- A. Bind in commercial quality, 8-1/2 by 11 inch, three-ring side binders with hardback, cleanable, plastic covers.
- B. Label cover of 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 principal.
- C. Table of Contents: Neatly typed, in sequence of Table of Contents of Project Manual, with each item identified with number and title of Specification Section in which specified, and name of product or Work item.
- D. Separate each warranty or bond with index tab sheets keyed to 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.

1.17 WARRANTIES - PREPARATION OF SUBMITTALS

- A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item or Work. Except for items put into use with District's permission, leave date of beginning of time of warranty until date of Certified Notice of Completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

1.18 WARRANTIES - TIME OF SUBMITTALS

- A. For equipment or component parts of equipment put into service during construction with District's permission submit documents within ten days after acceptance.
- B. Make other submittals within ten days after date of Certified Notice of Completion, prior to final Application for Payment.
- C. For items of Work when acceptance is delayed beyond date of Notice of Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty period.

1.19 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual Specification Sections.

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- B. Deliver to project site location as directed by District.

1.20 INSTRUCTIONS TO DISTRICT'S PERSONNEL

- A. Instruct District's personnel in proper operation and maintenance of all systems, equipment and similar items which were provided as part of Work. Provide maintenance and inspection schedules that conform to manufacturer's recommendations.
- B. Contractor shall provide schedule to District for approval for each of instruction periods required.
- C. Instruction sessions will be held in District designated area on project site and at District's convenience.
- D. Prepare and submit to Architect a sign-in sheet with subject, date and time, signed by all participants for each session.
- E. Instructors shall be qualified by product manufacturer in subject matter presented at each session.

PART 2 - PRODUCTS

2.01 MATERIALS - CUTTING AND PATCHING

- A. Primary Products: Those required for original installation.

2.02 PRODUCTS FOR PATCHING AND EXTENDING WORK

- 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 standard.

2.03 CLEANING MATERIALS AND EQUIPMENT

- A. Provide required personnel, equipment and materials needed to maintain specified standard of cleanliness.

2.04 COMPATIBILITY

- A. Use cleaning materials and equipment that are compatible with surfaces being cleaned, as recommended by manufacturer of material to be cleaned.

PART 3 - EXECUTION

3.01 EXAMINATION Ó CUTTING AND PATCHING

- A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching. Confirm status and current warranties and guarantees.
- B. After uncovering existing Work, inspect conditions affecting performance of Work.
 - 1. Prior to cutting, boring or drilling through new or existing structural members or elements including reinforcing bars not specifically detailed, Contractor shall prepare detailed drawings for review and approval by Architect, Structural Engineer of Record and DSA Field Engineer. Approval by DSA is required prior to commencement of Work. Agency approvals will be obtained by Architect not Contractor.
- C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION Ó CUTTING AND PATCHING

- A. Provide temporary support to ensure structural integrity of Work. Provide devices and methods to protect other portions of Project from damage.
- B. Provide protection from elements for areas that may be exposed by uncovering Work.
- C. Maintain excavations free of water.

3.03 CUTTING AND PATCHING

- A. Execute cutting, fitting, and patching to complete Work.
- B. Fit products together, to integrate with other Work.
- C. Uncover Work to install ill-timed Work.
- D. Remove and replace defective non-conforming Work.
- E. Provide openings in Work for penetration of mechanical and electrical Work.

3.04 PERFORMANCE - CUTTING AND PATCHING

- A. Execute Work by methods to avoid damage to other Work and which will provide appropriate surfaces to receive patching and finish.
- B. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval. Torches or other flame cutting equipment shall not be used to cut metal studs without prior approval of the Architect.
- C. Restore Work with new products in accordance with requirements of Contract Documents.

- D. Fit Work air tight to pipes, sleeves, ducts, conduits and other penetrations through surfaces.
- E. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- F. Extend patching to point where patching is not evident unless directed otherwise by Architect.

3.05 SLEEVES AND HANGERS

- A. Provide conduit, outlets, piping sleeves, boxes, inserts or other materials or equipment necessary to be built into Work. Promptly furnish same and set such sleeves or other materials as construction program required.
- B. In event delays occur in delivery of sleeves or other materials, arrange to have boxes or other forms set at locations where piping or other material is to pass through or into slabs or other Work.
- C. Upon subsequent installation of sleeves or other material, install fill materials as required. Necessary expenditures incurred for boxing out or filling shall be without extra cost to District.

3.06 PROGRESS CLEANING

- A. General:
 - 1. Retain stored items in orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing required protection of materials.
 - 2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
 - 3. At least twice each month, and more often if necessary, remove scrap, debris, and waste material from jobsite.
 - 4. Provide adequate storage for items waiting removal from jobsite, observing requirements for fire protection and protection of ecology.
- B. Site:
 - 1. Daily, and more often if necessary, inspect site and pick up all scrap, debris, and waste material. Remove items to place designated for their storage. Combustible waste shall be removed from site. Flammable waste shall be kept in sealed metal containers until removed from site.
 - 2. Weekly, and more often if necessary, inspect, arrangements of materials stored on site, re-stack, tidy, or otherwise service arrangements to meet requirements specified above.
 - 3. Maintain site in neat and orderly condition.
- C. Structures:
 - 1. Weekly, and more often if necessary, inspect structures and pick up scrap, debris, and waste material. Remove items to place designated for their storage.
 - 2. Weekly, and more often if necessary, sweep interior spaces clean.

- a. ÓClean• , for purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom, i.e., Óbroom-clean• .
3. As required preparatory to installation of succeeding materials, clean structures of pertinent portions thereof to degree of cleanliness recommended by manufacturer of succeeding material, using equipment and materials required to achieve required cleanliness.
4. Clean substrate; remove dirt, oil, grease, construction markings, and foreign matter that could adversely affect surface finish appearance or performance.
5. Following installation of finish floor materials, clean finish floor daily, and more often if necessary, and while Work is being performed in space in which finish materials have been installed.
 - a. Ó?Clean• , for purpose of this subparagraph, shall be interpreted as meaning free from foreign materials which, in opinion of Architect, may be injurious to finish floor material, i.e., Óvacuum clean• .

3.07 FINAL CLEANING

- A. Definition: Except as otherwise specifically provided, Óclean• , for purpose of Article, shall be interpreted as meaning level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials, i.e., "scrub and polish clean• .
- B. General: Complete following cleaning operations before requesting inspection for certification of Notice of Completion.
 1. Prior to completion of Work, remove from jobsite all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described above.
 2. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - a. Unless otherwise specifically directed by Architect, water and broom clean paved areas on site and public paved areas directly adjacent to site. Remove resultant debris.
 3. Rake grounds that are neither planted nor paved to smooth, even-textured surface.
 4. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- C. Structures:
 1. Exterior: In areas affected by Work under this Contract, visually inspect exterior surfaces and remove traces of soils, waste material, smudges and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve uniform degree of exterior cleanliness, hose down exterior of structure. In event of stubborn stains not removable with water, Architect may require light sandblasting or other cleaning at no additional cost to District.

2. Interior: In areas affected by Work under this Contract, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only cleaning materials and equipment instructed by manufacturer of surface material.
3. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
4. Polished Surfaces: On surfaces requiring routine application of buffed polish, apply polish recommended by manufacturer of material being polished. Glossy surfaces shall be cleaned and shined as intended by manufacturer.
5. Carpet: Use only dry-chemical method of cleaning. Steam cleaning or water based cleaning shall not be used on carpet. Use only dry-chemical materials and methods fully approved by carpet manufacturer, as instructed in manufacturer's published literature.
6. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

D. Mechanical and Electrical Systems

1. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
2. Replace parts subject to unusual operating conditions.
3. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
4. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
5. Clean ducts, blowers, and coils if units were operated without filters during construction.
6. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

- E. Timing: Schedule final cleaning acceptable to the Architect to enable District to accept completely clean project.

3.08 CLEANING DURING DISTRICT'S OCCUPANCY

- A. Should District occupy Work or any portion thereof prior to its completion by Contractor and acceptance by District, responsibilities for interim and final cleaning of occupied spaces shall be determined by Architect in accordance with General Conditions of the Contract.

END OF SECTION

SECTION 02 22 20

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected site elements.
 - 3. Salvage of existing items to be reused or recycled.
- B. Related Sections include the following:
 - 1. Division 1 Section "Summary" for use of premises and Owner-occupancy requirements.
 - 2. Division 1 Section "Photographic Documentation" for preconstruction photographs taken before selective demolition operations.
 - 3. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
 - 4. Division 1 Section "Construction Waste Management" for disposal of demolished materials.
 - 5. Division 1 Section "Cutting and Patching" for cutting and patching procedures.
 - 6. Division 2 Section "Building Demolition" for demolition of entire buildings, structures, and site improvements.
 - 7. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 SUBMITTALS

- A. Qualification Data: For demolition firm.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
 - 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 7. Means of protection for items to remain and items in path of waste removal from building.
- C. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- D. Predemolition Photographs or Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations. Comply with requirements in Division 1 Section "Photographic Documentation." Submit before Work begins.
- E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - 1. Comply with submittal requirements in Division 1 Section "Construction Waste Management."

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review and discuss requirements for temporary heat detectors. Confirm temporary fire detection and alarm system (heat detectors) have been tested in accordance with Section 13850m "Fire Detection and Alarm System Modifications" and installation is acceptable to the UC San Diego Fire Marshal.

1.6 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. TBD
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

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1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or preconstruction videotapes.
 1. Comply with requirements specified in Division 1 Section "Photographic Documentation."
- G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of selective demolition.
- D. Temporary Fire Detection and Alarm System – Heat Detectors: Inspect and confirm temporary heat detectors have been provided within areas to be demolished, heat detectors have been tested in accordance with Section 13850m "Fire Detection and Alarm System Modifications" and installation is acceptable to the UC San Diego Fire Marshal.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly.
- B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to location off site, as designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
 - 1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
- E. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 7 roofing Sections for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.
- F. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 4. Comply with requirements specified in Division 1 Section "Construction Waste Management."

- B. Burning: Do not burn demolished materials.
- C. Disposal: Unless otherwise indicated, transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 22 20

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

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.
- B. Latest edition of American Concrete Institute, ACI 318 and Manual of Concrete Practice (inclusive of all Parts).
- C. If conflict occurs between the Contract Drawings, the Project Manual, ACI 318, and the Manual of Concrete Practice, the most stringent takes precedence.

1.02 SUMMARY

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

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- B. Shore: Vertical or inclined support members designed to carry the weight of formwork, concrete, and construction loads above.
- C. Strength Test: The average of the strengths of at least two 6 by 12 inch cylinders or at least three 4 by 8 inch cylinders made from the same sample of concrete and tested at 28 days or at test age designated for determination of specified compressive strength of concrete.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

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- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - 2. Include qualified strength test records if design mixture is based on field experience.
 - 3. Include results of trial mixtures if design mixture is based on trial mixtures.
 - 4. Include results of modulus of elasticity tests on trial mixtures.
 - 5. Design mixture to be signed and sealed by a professional Civil or Structural Engineer licensed in the State in which the Project is constructed.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installers.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Vapor retarders, including subbase materials.
 - 9. Semirigid joint filler.
 - 10. Joint-filler strips.
 - 11. Repair materials.
- D. Material Test Reports: For the following, from a qualified Testing Agency, indicating compliance with requirements:
 - 1. Aggregates.
- E. ICC ES Evaluation Reports: For evidence of Building Code compliance:
 - 1. Mechanical splices and connectors for reinforcing steel.

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- F. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- G. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect
- H. Minutes of preinstallation conference.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5. [Sections 1 through 5 and Section 7, "Lightweight Concrete."]
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent Testing Agency to perform material evaluation tests and to design concrete mixtures.
- G. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review special inspection and Testing Agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

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1.07 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Structurally sufficient to support weight of plastic concrete and other superimposed loads.
 - 1. Expanded polystyrene (EPS); ASTM C578, Type XI.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips (19 by 19 mm).
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

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2.02 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.
- B. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, Grade 60, deformed.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Dowel Bar Sleeves: Circular PVC sleeve, sealed one end, dowel bar embedment plus 1 inch in length, and 1/16 inch annular space inside diameter.
- C. Deformed Bar Anchors: ASTM A1064/A1064M, deformed steel wire; AWS D1.1/D1.1M, Type C.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- E. Mechanical Splices and Connectors: Comply with ACI 318 and ACI 439.3R, Type I and Type II.
 - 1. Furnish splicing and connector system with current ICC ES Evaluation Report.
- F. Punching Shear Reinforcing for Slabs: Comply with ACI 318 and ACI 421.1R.
 - 1. Furnish shear reinforcing system with current ICC ES Evaluation Report

2.04 CONCRETE MATERIALS

- A. Regional Materials: Provide concrete that has been manufactured within 500 miles of Project site from aggregates and/or cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

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- B. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C150/C150M, Type I or Type II. Supplement with the following:
 - a. Fly Ash: ASTM C618, Class F.
- C. Normal-Weight Aggregates: ASTM C33/C33M, Class 1N coarse aggregate, well-graded. Provide aggregates from a single source.
 - 1. Maximum Coarse Aggregate Size: 1-1/2 inches nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C330/C330M, expanded shale, presize before firing, 3/4-inch nominal maximum aggregate size.
- E. Water: ASTM C 94/C94M.

2.05 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260/C260M.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.

2.06 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E1745, Class A, 15 mil. Include manufacturer's recommended adhesive or pressure-sensitive tape.
- B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent

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passing No. 200 sieve; complying with deleterious substance limits of ASTM C33/C33M for fine aggregates.

2.07 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
- B. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

2.08 LIQUID FLOOR TREATMENTS

- A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

2.09 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D2240.
- C. Reglets: Fabricate reglets in concrete to receive flashing from other trades of not less than 0.022-inch thick galvanized-steel sheet. See Division 07 Section "Sheet Metal Flashing and Trim". Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- D. Dovetail Anchor Slots: Provide as shown on Drawings. Hot-dip galvanized-steel sheet, not less than 0.034-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109/C109M.
- C. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete indicated on drawings, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent Testing Agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent maximum
 - a. Fly ash is not permitted in suspended slabs.
- C. Water-soluble chloride ion content shall be determined by ASTM C1218/C1218M at age between 28 and 42 days. Submit documentation verifying compliance. Limit water-soluble, chloride-ion content in hardened concrete to:
 - 1. 1.00 percent by weight of cement for mild-reinforced concrete.
 - 2. 0.06 percent by weight of cement for post-tensioned concrete.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

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PART 3 - EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117, unless specified otherwise in the Contract Documents.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete, unless otherwise indicated on Drawings.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

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- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."

3.03 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Granular Course: [Cover vapor retarder with][Place vapor retarder over]4-inch bed of granular fill, material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.

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1. Fine-Graded Granular Material: Place and compact a 1/2-inch layer of fine-graded granular material over granular fill.

3.05 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 1. Weld reinforcing bars according to AWS D1.4/D1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.06 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - a. Perform saw-cutting before concrete starts to cool, as soon as the concrete surface is firm enough not to be torn or damaged by the blade, and before random drying-shrinkage cracks can form in the concrete slab. Joints produced by conventional dry- or wet-cut process shall be made within 4 hours in hot weather and within 12 hours in cold weather after the slab has been finished.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint or use PVC dowel bar sleeve.

3.07 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into

lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Deviation from cross sectional thickness of suspended slabs shall not exceed $\pm 1/4"$.
 5. Deviation from elevation of suspended slabs before removal of supporting shores shall not exceed $+3/8"$ nor $-1/4"$.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.08 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.09 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, or built-up or membrane roofing.

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- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E1155, for a randomly trafficked floor surface:
 - a. Specified overall values (SOV) of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values (MLV) of flatness, F(F) 17; and of levelness, F(L) 15.
 - b. Specified overall values (SOV) of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values (MLV) of flatness, F(F) 24; and of levelness, F(L) 17; for surfaces to receive thin-set flooring.
 3. For floor installations 10,000 sq. ft. or less in total project area, finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (90 percent compliance) in accordance to ACI 117 Section 4.8.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lbs./100 sq. ft. of dampened slip-resistive aluminum granules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 2. After broadcasting and tamping, apply float finish.
 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aluminum granules.
- H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

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1. Uniformly apply dry-shake floor hardener at a rate of 100 lbs./100 sq. ft. unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.12 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply liquid to concrete sooner than that recommended by manufacturer.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

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3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
 - 4. Repair technique shall be tested on a mockup or surface to be concealed later, before repairing surfaces exposed to view, for approval by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

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1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified Testing Agency to perform field tests and inspections and prepare test reports.
- B. Inspections: Verify and inspect concrete Work as shown on Drawings.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

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1. Testing Frequency: Obtain at least one random composite sample for each 150 cu. yd. of concrete or 5,000 sq. ft. of surface area of slabs of walls, or fraction thereof, of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method, for normal-weight concrete; [ASTM C173/C173M, volumetric method, for structural lightweight concrete;]one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C567/C567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C31/C31M.
 - a. Mild-Reinforced and Post-Tensioned Slabs and Beams: Cast and laboratory-cure five standard cylinder plus one spare standard cylinder specimens for each composite sample.
 - 1) Cast and field-cure additional standard cylinder specimens to verify concrete strength for removal of shoring and reshoring in multistory construction. Number of field-cured cylinder specimens to be determined by Contractor.
 - 2) Cast and field-cure additional standard cylinder specimens to verify concrete strength for stressing of tendons in post-tensioned construction. Number of field-cured cylinder specimens to be determined by Contractor.
 - b. Shear Walls and Columns: Cast and laboratory-cure five standard cylinder plus one spare standard cylinder specimens for each composite sample.
 - c. Other Concrete Elements: Cast and laboratory-cure four standard cylinder plus one spare standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Mild-Reinforced Concrete Slabs and Beams: Test one laboratory-cured specimen at 4 days; one laboratory-cured specimen at 7 days or upon formwork stripping, whichever comes first; one laboratory-cured specimen at 14 days; and two laboratory-cured specimens at 28 days.
 - b. Post-Tensioned Concrete Slabs and Beams: Test one laboratory-cured specimen at age determined by contractor for tendon stressing;

- one laboratory-cured specimen upon formwork stripping or 7 days, whichever comes first; one laboratory-cured specimen at 14 days; and two laboratory-cured specimens at 28 days.
- c. Shear Walls, Columns and concrete pilaster: Test one laboratory-cured specimen at 7 days, one laboratory-cured specimen at 56 days and one laboratory-cured specimen at 90 days; and two laboratory-cured specimens at 28 days.
 - d. Other Concrete Elements: Test two laboratory-cured specimens at 7 days and two laboratory-cured specimens at 28 days.
 - e. A compressive-strength test at shall be the average compressive strength from a set of two specimens obtained from same composite and tested at the age indicated.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- a. If 28-day compressive-strength test falls below satisfactory levels, strength test the spare cylinder at age determined by the Contractor and average with the strength of the 28-day specimens. The average strength of the three cylinders shall be considered one compressive-strength test.
9. Modulus of Elasticity Test Specimens: ASTM C31/C31M.
- a. Shear walls, columns and concrete pilasters: Cast and field-cure eight two standard cylinder specimens plus two spares for each composite sample.
 - 1) Composite samples (consisting of 10 standard field-cured cylinder specimens) for each concrete strength, each concrete mix design and for each aggregate source, shall be randomly selected from every five floors, with two random composite samples minimum per building.
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing.
- a. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete Testing Agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for each age tested.
 - b. Reports of modulus of elasticity tests shall contain Project identification name and number, mix identification number, specimen identification number, curing and environmental history of specimen, date of test, name of Testing Agency, and plot of the results with age of concrete as the abscissa and modulus of elasticity as the ordinate.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

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12. Additional Tests: Testing Agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing Agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E1155 within 24 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 03 48 00

PRECAST CONCRETE SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Architectural precast concrete exterior components, splash blocks.
- B. Supports, anchors and attachments.

1.02 REFERENCE STANDARDS

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ASTM C33 - Concrete Aggregates.
- C. ASTM C150 - Portland Cement.
- D. ASTM C494 - Chemical Admixture for concrete.
- E. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- F. PCI MNL 117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete.

1.03 SUBMITTALS

- A. Shop Drawings: Indicate unit identification marks, connection details, support items, show all joint and connection details and their relation to supporting structure, dimensions, openings and relationship to adjacent materials.
 - 1. Provide details, dimensional tolerances and other information required for coordination of all work with the work of this Section.
- B. Three samples, illustrating surface finish, color, profile and texture.
- C. Maintenance Data: Indicate surface cleaning instructions.

1.04 QUALITY ASSURANCE

- A. Qualifications
 - 1. Fabricator: Company specializing in performing the work of this Section with minimum five years' experience.
- B. Mock-Up
 - 1. Provide under provisions of Division 01, General Requirements.
 - 2. Provide mock-up of each section where specialty item occurs.
 - a. Mock-up panel to include sealant application where indicated.
 - b. Locate on site and where approved.

- c. Accepted mock-up may remain as part of the Work.
- C. Pre-installation Conference
 - 1. Convene two weeks prior to commencing work of this Section.
- 1.05 DELIVERY, STORAGE AND HANDLING
 - A. Protect units to prevent staining, chipping or spalling of concrete.
- 1.06 FIELD MEASUREMENTS
 - A. Verify field measurements.
- 1.07 WARRANTY
 - A. Provide under provisions of Division 01, General Requirements.
 - B. Warranty shall state that all work is free from defects in materials and workmanship for a period of two years from the date of Certified Completion. Contractor shall agree to repair or replace defective materials and workmanship during the warranty period at no additional cost to the Owner.
 - C. Defective materials and workmanship is hereby defined to include evidence of abnormal deterioration, aging or weathering of the work, structural failure resulting from exposure to normal loads and forces, sealant failures, deterioration or discoloration of finishes in excess of normal weathering and aging.

PART 2 - PRODUCTS

- 2.01 MANUFACTURERS
 - A. Products of following manufacturers form the basis for design and quality intended.
 - 1. Dura Art Stone, Fontana, CA.
 - 2. Wausau Tile, Wausau, WI
 - 3. Architectural Molded Products, Los Angeles, CA.
 - 4. Concrete Designs, Inc., Tucson, AZ.
 - 5. Stepstone Inc. Gardena, CA
 - 6. Moonlight Molds, Inc. Gardena, CA.
 - B. Or equal as approved in accordance with Division 01 General Requirements for substitutions.
- 2.02 CONCRETE MATERIALS
 - A. Cement: ASTM C150, Type I or II, white-gray mix for natural finish, white for coloring.
 - B. Concrete Materials: ASTM C33; water and sand.
 - 1. Coarse Aggregate: maximum size 3/4".
 - C. Integral color: ASTM C979, natural mineral-oxide type, limeproof and nonfading.

- D. Admixtures: ASTM C494, Type A, water reducing, manufacturer's recommended type.
- E. Surface Finish: "TRAVERTINE" texture, .
 - 1. Color: As selected by Architect from Manufacturer's product line.

2.03 SUPPORT DEVICES

- A. Connecting and Support Devices: Minimum 20 gauge corrugated galvanized inserts, where indicated on drawings.
- B. Bolts, Nuts and Washers: ASTM A307.

2.04 ACCESSORIES

- A. Sealant: Two component polyurethane, as specified in Section 07 92 00.

2.05 MIX

- A. Concrete: Minimum 5,000 psi, 28 day strength.

2.06 FABRICATION

- A. Use rigid molds, constructed to maintain precast unit uniform in shape, size and finish.
- B. Maintain consistent quality during manufacture.
- C. Fabricate connecting devices, plates, angles, inserts, bolts and accessories. Fabricate to permit initial placement and final attachment.
- D. Embed anchors, inserts plates, angles or other cast-in-place items as required for the component configuration.

2.07 FINISH - PRECAST UNITS

- A. Finish: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance and identical to approved samples.

2.08 MANUFACTURERS - LATEX-PORTLAND CEMENT ADHESIVE AND GROUT

- A. Custom Building Products, Bell, CA.,
- B. Or equal as approved in accordance with Division 01 General Requirements for substitutions.

2.09 SETTING BED MATERIALS

- A. Portland Cement: ASTM C150, Type I or II.
- B. Sand: ASTM C33.
- C. Water: Potable.

2.10 SETTING-BED MIX

- A. 1 sack Portland cement and 1 sack no. 30 or no. 60 silica sand and 5 gallons latex.
- B. Mixing: Thoroughly mix dry ingredients before adding water to obtain proper consistency. Discard mortar when it has reached its initial set.
- C. Mortar that will be exposed shall be pigmented to match approved samples.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify site conditions.
- B. Verify that substrate, structure, anchors, devices and openings are ready to receive work of this Section.

3.02 APPLICATION

- A. Remove all traces of deleterious materials from substrate.
- B. Arrange units for similar - appearing assemblies and spacing.
- C. Field cut units for proper sizing and placement. Utilize Diamond Blade equipment only.
- D. Install precast architectural concrete units level, plumb, square, and true.
- E. Allow maximum 3/8 inch joints between units.
- F. Align and maintain uniform horizontal and vertical joints as erection progresses.
- G. Assure complete contact between units and mortar.
- H. Allow minimum 72 hours for mortar to cure.
- I. Grout joints with approved pigmented mortar, concave joints.

3.03 ADJUSTING

- A. Adjust units so that joint dimensions are within tolerances.

3.04 PROTECTION

- A. Protect work from damage.

3.05 CLEANING

- A. Clean exposed facings to remove dirt and stains that may be on units after erection and completion of joint treatment. Wash and rinse in accordance with manufacturer's recommendations. Protect other work from damage due to cleaning operations. Do not use cleaning materials or processes that could change the character of exposed finishes.

3.06 REPAIRS

- A. Conduct inspections, perform testing and make repairs or replace unsatisfactory precast units.
- B. Limitations as to the amount of patching that will be permitted is subject to approval of Architect.
- C. In addition to above, units may be rejected for anyone of the following:
 - 1. Exceeding the specified installation tolerances.
 - 2. Damaged during construction operations.
 - 3. Exposed-to-view surfaces that develop cracks or surface finish deficiencies.

3.07 SCHEDULE

- A. As indicated on Drawings.
- B. Architectural precast concrete exterior components,
 - 1. Splash blocks

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

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.
09 90 00 - Painting

1.02 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections:
 - 1. Division 09 painting Sections and Division 09 Section "High-Performance Coatings" for surface-preparation and priming requirements.

1.03 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SFRS" or elements along grid lines designated as "SFRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
 - 2. Welded built-up members with plates thicker than 2 inches (50 mm).
 - 3. Column base plates thicker than 2 inches (50 mm).
- D. Protected Zone: Structural members or portions of structural members of the SFRS indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

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- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 5. Identify members and connections of the seismic-load-resisting system.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing. For demand critical welds include the following:
 - 1. One or more combination of welding variables (e.g. power source, volt, amp, travel speed, etc.) that produces heat input within the range used for the WPS Heat Input Envelope Test.
 - 2. Electrode manufacturer and trade name.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.

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3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Source quality-control reports.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 341 and AISC 341s1.
 3. AISC 358.
 4. AISC 360.
 5. RCSC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 6. AWS D1.1/D1.1M.
 7. AWS D1.8/D1.8M.
- E. Preinstallation Conference: Conduct conference at Project site.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

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1. Fasteners may be repackaged provided Owner's Testing Agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.08 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 1. W-Shapes: 60 percent.
 2. Channels, Angles, M, S-Shapes: 60 percent.
 3. Plates and Bars: 25 percent.
 4. Cold-Formed Hollow Structural Sections: 25 percent.
 5. Steel Pipe: 25 percent.
 6. All Other Steel Materials: 25 percent.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels, Angles, M-, S-Shapes: ASTM A 36/A 36M.
- D. Plates and Bars: ASTM A 36/A 36M, typical; ASTM A 572/A 572M, Grade 50, when used in SLRS connection (345).
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 1. Finish: Black [except where indicated to be galvanized].
- G. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish; where indicated on Drawings.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating. All threaded components of the fastener assembly must be galvanized by the same process. Mixing high-strength bolts that are galvanized by one process with nuts that are galvanized by the other is not permitted.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- E. Shear Connectors: ASTM A 108, Grades 1010 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- F. Headed Anchor Rods: ASTM F 1554, Grade 36, typical; ASTM F 1554, Grade 55, weldable, when used in SLRS; straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 4. Finish: Plain.
- G. Threaded Rods: ASTM A 36/A 36M.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

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3. Finish: Plain.

- H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.
- K. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement along one or two axes.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product.
 - 2. Mating Surfaces: PTFE and PTFE.
 - 3. Coefficient of Friction: Not more than 0.06 at 2,000 psi bearing pressure.
 - 4. Design Bearing Pressure: Not greater than 2,000 psi (13.7 MPa).

2.03 PRIMER

- A. Low-Emitting Materials: Paints and coatings 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", including 2004 Addenda.
- B. Primer: Comply with Division 09 painting Sections and Division 09 Section "High-Performance Coatings."
- C. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.
- D. Galvanizing Repair Paint: ASTM A 780.

2.04 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Camber structural-steel members where indicated.

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2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened unless noted otherwise on Drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

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2.07 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Top flange of beams supporting steel decking.
 - 4. Surfaces to be high-strength bolted with slip-critical connections.
 - 5. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 6. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.08 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Determine, furnish and install all temporary supports, such as temporary guys, beams, braces, falsework, cribbing or other elements required for the erection operation.

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These temporary supports shall be sufficient to secure the bare structural steel framing or any portion thereof against loads that are likely to be encountered during erection, including those due to wind and those that result from erection operations. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless noted otherwise on Drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified independent Testing Agency to inspect field welds and high-strength bolted connections and prepare test reports.
- B. Inspections: Verify and inspect structural steel Work as shown on Drawings.
- C. Bolted Connections: Bolted connections will be tested and inspected according to RCSC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at Testing Agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
- E. SFRS Connections: Test and inspect SFRS connection elements as indicated in accordance to AISC 341, AWS D1.1/D1.1M and AWS D1.8/D1.8M.
- F. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

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1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Testing Agency, where warranted, may select a reasonable number of additional studs to be subjected to the bend tests.
- G. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated ferrous metal items, galvanized and prime painted.
- B. Related Sections
 - 1. Section 09 06 00, Schedules for Finishes.
 - 2. Section 09 90 00, Painting.

1.2 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. American Society of Mechanical Engineers (ASME)
 - 1. ASME B18 -Fasteners
- C. ASTM International
 - 1. ASTM A36/A36M Carbon Structural Steel
 - 2. ASTM A48/A48M Gray Iron Castings
 - 3. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless
 - 4. ASTM A123 Zinc (Hot-Dip Galvanized) on Coatings on Iron and Steel Products
 - 5. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 6. ASTM A283/A 283M Low and Intermediate Tensile Strength Carbon Steel Plates
 - 7. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - 8. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/105ksi Minimum Tensile Strength
 - 9. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
 - 10. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
 - 11. ASTM A563 - Carbon and Alloy Steel Nuts
 - 12. ASTM A653/A 653M Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 13. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 14. ASTM A786/A 786M Rolled Steel Floor Plates
 - 15. ASTM A992 Structural Steel Shapes
 - 16. ASTM B633 - Electrodeposited Coatings of Zinc on Iron and Steel
 - 17. ASTM C1107 - Packaged Dry Hydraulic - Cement Grout (Non-Shrink
 - 18. ASTM D520 ASTM D520 - Zinc Dust Pigment
 - 19. ASTM F1554 - Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- D. American Welding Society (AWS)

1. AWS A2.4 - Standard Symbols for Welding, Brazing and Non-Destructive Examination
 2. AWS A5.1 - Carbon Steel Covered Arc-Welding Electrodes
- E. ASCE/SEI 7-05 - American Society of Civil Engineers, Structural Engineers Institute, ASCE Standard.
- F. California Code of Regulations (CCR)
1. Title 8, Chapter 3.2
 2. Title 8, Division 1, Subchapter 7, Group 1, Article 4, Section 3277, Fixed Ladders
 3. Cal/OSHA, Subchapter 4 Construction Safety Orders
 4. Title 24, Part 2, 2016 California Building Code (CBC), Chapter 22A.
 5. Title 24, California Fire Code Chapter 26 Welding and Other Hot Work.
- G. National Ornamental & Miscellaneous Metals Association (NOMMA)
1. NOMMA Guidelines - Guideline 1 Joint Finishes
- H. SSPC - The Society for Protective Coatings
1. Paint 20 - Zinc-Rich Coating (Type I Inorganic and Type II Organic)
 2. SP-2 - Steel Preparation
- I. MIL - Military Specifications, United States Department of Defense
1. P-21035 - Paint, High Zinc Dust Content, Galvanizing Repair
- J. MPI - Master Painters Institute Approved Products List
1. 18 - Primer, Zinc Rich, Organic
 2. 19 - Primer, Zinc Rich, Inorganic

1.3 SUBMITTALS

- A. Shop Drawings. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Include erection drawings, elevations and details where applicable. Indicate welded connections using standard AWS A2.4 Welding Symbols. Indicate net weld lengths.
- B. Welder Certifications.
- C. Manufacturer's Certificates certifying welders employed on the work have been AWS qualified within the previous 12 months, in accordance with AWS-WHB-1.
- D. Written Welding Procedure Specification (WPS)

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following
1. AWS D1.1, Structural Welding Code--Steel.
 2. AWS D1.3, Structural Welding Code--Sheet Steel.
 3. AWS D1.8, Structural Welding Code – Seismic Supplement.
 4. AWS Certified welders.
 5. AWS - American Welding Society

6. AWS A2.4 Standard Symbols for Welding, Brazing and Non Destructive Examination

- B. Coating applicator - Galvanized Metal Fabrications: Company specializing in hot-dip galvanizing after fabrication and following the procedures in the Quality Assurance Manual of the American Galvanizers Association.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Steel Sections: ASTM A992 for W-Shape sections and ASTM A36 for all other members.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Bending or cold-formed steel: ASTM A283, Grade C.
- D. Floor/Stair Plate: ASTM A786, Pattern No. 5, medium pattern, raised lug pattern, 12 gauge. Steel ASTM A36 or ASTM A283 Mild Steel, Grade C or D.
- E. Steel Round Structural Tubing: ASTM A500, Grade C, minimum yield strength, 46 ksi.
- F. Structural Tubing: Hollow Structural Sections (HSS), ASTM A500, Grade B, minimum yield strength, 42 ksi.
- G. Pipe: ASTM A53, Grade B, Type E or S, Schedule 40, galvanized where indicated.
- H. Cast Iron: ASTM A48/A48M, Class 30, unless another class is indicated or required by structural loads.
- I. Cast steel: ASTM A27, Grade 65-35.
- J. Square and rectangular steel tubing structural: carbon steel conforming to ASTM A500 or ASTM A36.
- K. Mechanical Tubing: ASTM A 513 hot- or cold-rolled carbon steel for non-structural tubing, electric welded tubing.
- L. Abrasive-Surface: for stair rungs, floor plate, with abrasive material metallurgically bonded to steel by a proprietary process, OSHA compliant.

2.3 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563 and ANSI B18.2.1; and, where indicated, flat washers and ASTM A325 as indicated on drawings.
- C. High Strength Bolts ASTM A325.
- D. Anchor Bolts ASTM F1554, Grade 36.
- E. Machine Screws ASME B18.6.3.
- F. Lag Bolts ASME B18.2.1.
- G. Wood Screws Flat head, carbon steel, ASME B18.6.1.
- H. Plain Washers Round, carbon steel, ASME B18.22.1.
- I. Lock Washers Helical, spring type, carbon steel, ASME B18.21.1.
- J. Eyebolts: for wood, steel or concrete construction, Stainless steel Type 304. 1/4" shoulder pattern, rated 500 lbs. minimum. Epoxied in Concrete where indicated.
- K. Threaded rods, steel yokes and plates.
- L. Self-drilling, self-tapping screws, ASTM C954, galvanized, minimum #10 unless noted otherwise on drawings. By Buildex/Tomarco or equal.
- M. Anchorage Devices, Drilled Expansion Anchors Minimum 5/8-inch diameter with 3 inch embedment unless noted otherwise on drawings. Allowable shear and tension values as permitted in ICC-ES, ESR-1917 Hilti Kwik Bolt TZ Concrete Anchor or Hilti Kwik Bolt 3, ESR-1385 for masonry anchors, by Hilti Inc., Tulsa, OK, or in ICC-ES 2502, DeWalt Power-Stud+SD2 concrete anchor or DeWalt Power-Stud+ SD1, ESR-2966 for masonry anchors, by Dewalt, Towson, MD.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primer: Fabricator's rust inhibitive primer suitable for finish scheduled in Section 09 90 00 equal to L69 Hi Build Epoxoline II @ 3-4 mils DFT primer, red color, air dried, by Tnemec.
- B. Galvanizing Repair Compound: ASTM D520 Type III, MIL-P-21035, SSPC-Paint 20, or MPI #18 or 19. Touch-Up products for Galvanized Surfaces Ready mixed Zinc rich galvanizing compound, 95% zinc.
 - 1. Finish: Galviline by ZRC Products Company, Marshfield, MA or equal. Reflective Metallic Sheen for exposed galvanized finish.
 - 2. Finish: ZRC Products Company, Marshfield, MA or equal. Primer for repaired galvanized to receive a painting finish.

- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- D. Grout ASTM C1107, Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 8,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

2.5 FABRICATION

- A. Fit and shop assemble in largest practical sections for delivery to site.
- B. Ease exposed edges to small uniform radius.
- C. Fabricate items with joints tightly fitted and secured.
- D. Welded Joints. Seal joined members by continuous welds. Dress welded joints, leaving no burrs, or sharp or abrasive corners, edges or surfaces.
 - 1. Where exposed to view, dress welds in accordance with NOMMA Guidelines for Finish 1.
 - 2. Where concealed, dress welds in accordance with NOMMA Guidelines for Finish 3.
- E. Exposed Mechanically Fastened Joints. Make exposed, mechanically fastened joints hairline-tight, flush, butt joints. Secure with flush-mount, countersunk, screws or bolts; unobtrusively located; consistent with design of component, except where specifically indicated otherwise.
- F. Provide components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as related metal fabrication, unless expressly indicated otherwise.

2.6 FINISHES

- A. Steel and Iron
 - 1. Clean surfaces of rust, scale, grease and foreign matter prior to finishing. Prepare in accordance with SSPC SP-2.
 - 2. Galvanize steel items to zinc coating thickness in accordance with ASTM A123, minimum Coating Grade 80 (1.9 oz/sq. ft.). Surfaces shall be free of icicles, spangles and puddling. Provide venting holes at all enclosed sections, "V" notch, and drilled holes are acceptable. Locate to prevent rainwater from entering enclosed sections at exterior galvanized items. For sheet steel items, galvanize per ASTM A653 G60 Coating Designation.
 - 3. Galvanized items to be painted: Do not use quenching solutions or treatments immediately after galvanizing. Refer to individual sections for galvanized items to be painted and to Section 09 90 00.
 - 4. Do not prime surfaces in direct contact with concrete or where field welding is required.
 - 5. For painted surfaces, prime items with two coats in accordance with requirements of primer specified herein.

6. Color Coated with Finish Special Coatings in accordance with Section 09 90 00 Painting for exposed surfaces.
- B. Apply two coats of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious materials or between dissimilar metals. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Do not begin installation until unsatisfactory conditions are corrected. Beginning installation means acceptance of existing conditions including the preparatory work of others, if any.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on shop drawings.
 1. Weld joints using shielded metal-arc welding (SMAW) method. Use coated welded rods, not fluxed, or type recommended by manufacturer for use with parent metal. Use only certified welders for structural construction.
 2. Grinding: Grind welds on surfaces subject to traffic or contact to smooth flush joints.
 3. Peening: Remove flux and weld spatter as necessary to eliminate unsightly conditions and grind off sharp projections.
 4. Permanently Concealed Welds: No treatment required other than preparation for painting or galvanizing.
- D. Perform field welding in accordance with AWS standards and procedures for metal alloy welded.
- E. Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions and surfaces not shop primed except surfaces to be in contact with concrete.

- G. Repair of Galvanized Surfaces: Ready mixed, zinc-rich galvanizing compound, ASTM A780 - A2. Repair Using Paints Containing Zinc Dust, minimum thickness 5 mils.
- H. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of alkali-resistant bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.4 ERECTION TOLERANCE

- A. Maximum Variation From Plumb 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment 1/4 inch.

3.5 FINISHES

- A. Paint with Gloss Polyurethane High Performance Coatings in Special Coatings per Section 09 90 00 Painting.

3.6 SCHEDULE

- A. Schedule is list of principal items only. Refer to Drawing details for items not specifically scheduled.
- B. Fasteners: Provide fasteners and connectors of approved types, whether indicated or not.
- C. Interior Vertical Access Ladder: minimum 16 inch ID wide tread surface on rungs.
 - 1. Side Rails: 3/8 inch by 2 inch steel bar.
 - 2. Rungs: 3/4-inch diameter solid steel rod spaced 12 inches on center vertically with knurled or skid-resistant surface.
 - 3. Mounting Brackets: 3/8-inch thick L-bent plate 8-1/2-inches by 3-inch legs, 4-inches deep, fabricated to provide 7 inches clearance from wall surface. Furnish steel wall backing plates, brackets, and anchors required for 48 inches, maximum on center spacing.
 - 4. Ladder safety post: Bilco LadderUP Safety Post Model LU-2, hot-dip galvanized steel construction, or equal, telescoping tubular section with automatic lock when extended. Upward and downward movement controlled by stainless special alloy steel spring balancing mechanism. Secure to ladder rungs with manufacturer's fasteners.
 - 5. Safety Post: as specified in Section 07 72 00.
 - 6. Finish: paint per Section 09 90 00.
- D. Steel Corner Guards: McNichols Designer Textured Metal, 6-OM, 48" x 24", 16GA SS-304, 60" high steel angle corner guards as detailed. Hot dip galvanized after fabrication.
- E. Metal Wall Protection: McNichols Designer Textured Metal, Tread Tex, 16 GA, pre-galvanized finish.
- F. Miscellaneous Framing and Supports, Trash Enclosures.

1. Provide steel framing, or aluminum framing if indicate, and panels and supports as indicated in Drawings and as necessary to complete Work.
 2. Fabricate units from structural or hollow steel shapes, plates, structural supports, sheet metal and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 3. Hinges: Heavy-duty weld-on I type. Minimum 3 per leaf rated at 1000 lbs. each hinge.
 4. Enclosures and Gates As indicated on Drawings
 - a. Gate Infill Panels for Trash Enclosures, sheet metal, 1-1/2 inches deep 36 inch panels, 18 gauge, G90 galvanized coated steel ASTM A653 . Box Rib by BHP Steel Building Products or equal. Paint per Section 09 90 00. Color to be selected by Architect.
 5. Refer to drawings for custom fabrication per details.
 6. Paint per Section 09 90 00 Painting, color to be selected by Architect.
- G. Railing and Handrails as detailed, refer to Section 05 52 14 for additional requirements.
- H. Vertical Steel Trellis: steel angle on 4 sides with holes and steel wire.
1. Refer to Drawings.
- I. Wire Mesh Panel: McNichols Echo Mesh Panel
1. Material:
 - a. Steel Plates, Shapes, and Bars: ASTM A36/A36M
 - b. Steel Tubing: ASTM A500, Cold-formed steel tubing
 - c. Steel Pipe: ASTM A53/A53M, standard weight (schedule 40), unless otherwise noted.
 2. Mesh: 2" x 2" mesh, 0.135 wire diameter.
 3. Dimensions: as indicated on drawings
 4. Weave: intercrimp
 5. Finish: Galvannealed, grey, unless noted otherwise.
 6. Trim: edge trim channel shall be the panel width with 1" returns, 16 gauge galvanized steel welded to the wire frame panels with all exterior surfaces ground smooth. Finish to match wire.
 7. Clips: all mount clips shall be fabricated from minimum 12 gauge to 16 gauge, metal to match screen wire. All bending, forming and drilling shall be done prior to powder coat finish. All two piece mounting clips are to be jointed with 3/8" diameter x 1-1/2" stainless steel round head hex bolt with nylon lock hex nut and washers.
 8. Posts: shall be sizes as indicated on drawings, ASTM A-500, with finish to match panels.

END OF SECTION

SECTION 05 52 14

SITE METAL FABRICATIONS

PART I - GENERAL

1.01 WORK INCLUDED

- A. The work includes the furnishing and installing of all miscellaneous metal items and related connections including handrails and other miscellaneous metal items as shown on the landscape drawings complete as shown and noted on the drawings and as specified herein.

1.02 REFERENCES

- A. The editions referenced herein, of federal specification (Fed. Spec.) And of the other standards and specifications published by the following organizations, apply to the work only to the extent specified by the reference:

American national standards institute (ANSI).
American institute of steel construction (AISC).
American society for testing and materials (ASTM).
American welding society (AWS).
Consumer Products Safety Commission (CPSC)

1.03. SUBMITTALS

- A. Shop drawings

1. Submit fully detailed shop drawings of all miscellaneous metal work giving sizes; details of fabrication and construction; methods of assembly and bracing; and locations of hardware, anchors, and all accessories.
2. Drawings shall include all shop and erection details, including cuts, copes, connections, holes, blots and welds. All welds, both shop and field, shall be indicated by standard welding symbols in AWS d1.1-81. Drawings shall show the size, length and type of each weld. All materials to be brazed or soldered shall have connection indicated by symbols that are industry standards.
3. Contractor shall be responsible for all fabrication and for correct fitting of metal members shown on shop drawings. No materials shall be fabricated or delivered to the site until the shop drawings have been approved and returned to the contractor.

1.04 DELIVERY AND STORAGE OF MATERIALS

- A. Deliver material in time to insure uninterrupted progress of the work. Materials shall be stored in a manner to preclude damage and permit ready access for inspection and identification of each shipment. Steel materials, either plain or fabricated, shall be stored above the ground upon platforms, pallets, skids, or other supports. Materials shall be kept free from dirt, grease, and other foreign matter, and shall be protected from corrosion. Material showing evidence of damage will be rejected and shall be immediately removed from the work.

1.05 FIELD MEASUREMENTS AND TEMPLATES

- A. Secure all field measurements required for proper and adequate fabrication and installation of the work. Furnish templates for exact location of items to be embedded in concrete and setting instructions required for all installation work.

PART 2 - PRODUCTS

2.01 STEEL

- A. Steel rolled shapes, bars and plates: Standard structural sections, conforming to ASTM a36-84a.
- B. Steel pipe: conform to ASTM a 53, schedule 40.
- C. Steel tubes: Conform to ASTM a 501 or a 500, grade b, and shall be seamless tube.
- D. Anchors, bolts, and fastenings: Bolts and nuts shall conform to ASTM a 307, grade a and ASTM a 563.
- E. Electrodes: All arc welding electrodes shall conform to AWS ws a5.1-81 or a5.5-81 e60xx or e70xx.
- F. Shop primer for steel shall meet federal specification tt-p-645 (zinc chromate).
- G. Pipe sleeves
 - 1. Pipe sleeves through concrete walls and footings shall be standard weight, wrought iron, mild steel, or cast iron sleeves with not less than 1/2 inch space all around between the sleeve and pipe.

2.02 GROUT

- A. Quick setting hydraulic cement shall be one of the following or equal, installed per manufacturers directions:
 - Hallemite/Lehn and Fink; Por-Rok
 - Thorsystem products; Thorogrip

Master builders; Masterflow 713

2.03 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:

1. Bolts with Nuts:
 - a. ASME B18.2.2.
 - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
 - c. ASTM F468 for nonferrous bolts.
 - d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.
5. Field riveting will not be approved.
6. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.

2.04 METALS SEPARATION

- A. Separate dissimilar metals with inert coatings, tape or washers. Use 1.7 mil polypropylene tape to separate large areas of adjoining flat metals. Use neoprene washers between metals at fasteners. Use nylon washers to separate fasteners from dissimilar metal parts.

2.05 WELDS

- A. Welds are to be sized and shaped to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.

PART 3 - EXECUTION

5028014-100
Cuyamaca College Track and Field
Improvements PH. II - Scoreboard

SITE METAL FABRICATIONS
05 52 14 - 3

3.01 GENERAL REQUIREMENTS

- A. All steel and miscellaneous metal work shall conform to the applicable requirements of the herein before referenced "codes and standards". All details shown are typical. Similar details apply to similar conditions. Drawings shall be checked with the Architectural drawings for dimensions, elevation, size, and locations of all installations. All miscellaneous metal items shall be supplied in ample time for incorporation in the work. Include all reinforcing angles, plates, straps, brackets, hangers, clips, lugs, holes, sleeves, shims, etc., As shown or required for erection of steel and miscellaneous metal work and as required to complete the work as shown on the drawings.
- B. Furnish members in longest lengths commercially available within the limits shown and specified.

3.02 CONDITION OF SURFACE

- A. Inspect all surfaces and footings to receive handrails or guard rails and report all defects that would interfere with this installation.

3.03 FABRICATION

- A. Materials shall be fabricated and assembled in the shop to the greatest extent possible. Shearing, flame cutting, and chipping shall be done carefully and accurately. Coordinate all connection details to concrete or masonry. Verify all lines, levels, and dimensions, where possible, just prior to commencing fabrication of connection details. Correct work that does not fit. Schedule and coordinate work under this section with that specified elsewhere in order to produce a workmanlike installation. When not otherwise shown or specified, comply with all applicable requirements of AISC "specifications for design, fabrication and erection of structural steel for buildings". Finished surfaces of all exposed members shall be smooth and free of any markings, burrs, or other defects.
- B. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
- C. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
- D. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades. Prepare members for the installation and fitting of hardware.
- E. Connections shall be bolted, brazed or welded as indicated. One-sided or other types of eccentric connections will not be permitted unless shown in detail and approved on the shop drawings.

- F. Holes shall be cut, drilled, or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Holes in base or bearing plates shall be drilled. Holes shall be provided in members to permit connection the work of other trades.
- G. Provide all surfaces free of file marks, dents, hammer marks, wire edges or any unsightly surface defects.
- H. Fabricate rails of steel tube and bar as indicated on the drawings. Miter and weld frames at corners. Weld verticals and horizontals to frames and dress weld smooth.

3.04 FINISHING

- A. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
- B. Steel and Iron: NAAMM AMP 504.
 - 1. Surfaces exposed in the finished work:
 - a. Finish smooth rough surfaces and remove projections.
 - b. Fill holes, dents and similar voids and depressions with epoxy type patching compound.
 - 2. Shop Prime Painting:
 - a. Surfaces of Ferrous metal:
 - 1. Items not specified to have other coatings.
 - 2. Galvanized surfaces specified to have prime paint.
 - 3. Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
 - 4. Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
 - 5. After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

3.05 WORKMANSHIP

- C. Set all work plumb, true, rigid and neatly trimmed out. Miter corners and angles of exposed moldings and frames unless otherwise noted.
- D. Fit exposed connections accurately together to form tight hairline joints.

3.06 ATTACHMENTS

- A. Do all cutting, shearing, drilling, punching, threading, tapping, etc., required for site metalwork or for attachment of adjacent work. Drill or punch holes; do not use cutting torch. Shearing and punching shall leave true lines and surfaces.
- B. Set all railings and similar items shown or required to be set in sleeves with quick setting non-shrink anchor cement. Unless otherwise noted, size sleeves for approximately 1/4 in. clearance all around.

3.07 OTHER CONNECTORS

- A. Make all permanent connections in metal surfaces using welds where at all possible.
- B. Do not use bolts or screws where they can be avoided.

3.08 WELDING

- A. Standards:
 - 1. AWS Code D1.0.
 - 2. Welding only by operators experienced in the type of work indicated.
- B. Preparation: Remove all rust, paint, scale and other foreign matter. Wire brush all flame-cut edges. Clamp members as required and alternate welds, all as necessary to prevent warping or misalignment.
- C. Exposed Welds: Uniformly make and grind smooth all welds normally exposed to view in the finish work.
- D. Do not weld galvanized units after hot-dipping.
- E. Faulty and Defective Welding; Chip out and replace all welding showing cracks, slag inclusion, lack of fusion, bad undercut or other defects ascertained by visual or other means of inspection. Replace and re-weld at no cost to Government.
- F. Field Welding:
 - 1. Procedure: Comply with AWS code of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
 - 2. Protection: Protect all adjacent surfaces from damage due to weld sparks, spatter, or tramp metal.

3.09 SURFACE TREATMENT AND PROTECTIVE COATINGS

- A. Thoroughly clean all mill scale, dirt, grease and other foreign matter from ferrous metal prior to any final finishing.

3.10 PAINTING

- A. After material has been properly cleaned, immediately apply primer and or paint to items noted on the plans to be painted. Apply all paints per manufacturer's current printed instructions. Spot paint all abrasions and field connections after assembly. Dry shop coats prior to shipment to job site.

3.11 INSTALLATION

- A. Miscellaneous metal items shall be installed as rapidly as the progress of other work will permit. Splices and field connections shall be made with bolts, except where welding or brazing is indicated or approved on the shop drawings. Fasteners shall be installed as specified hereinafter.
- B. Metal work shall be set accurately at the established lines and levels. Installation shall be in strict accordance with approved drawings and actual conditions, true and horizontal or perpendicular as the case may be, level and square with angles and edges parallel with related lines of the building.
- C. Anchor bolts, anchors, block-outs, and sleeves shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts.
- D. After assembly, the various members forming parts of a completed frame shall be aligned and adjusted accurately before being fastened. Tolerances shall conform to the applicable requirements of AISC "code of standard practice". Contact shall be cleaned before the members are assembled. Poor matching of holes shall be corrected by drilling to the next larger size.

3.12 TOUCH-UP AND PROTECTION

- A. Touch-up: Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint. Paint exposed areas with same material to same dry-film thickness as used for shop painting.
- B. Protection: Protect the work from all damage or discoloration until acceptance of work.

3.13 CLEAN-UP

- A. Keep all areas of work clean, neat and orderly at all times. Keep paved areas clean during installation.
- B. Clean up and remove all debris from the entire work prior to Final Acceptance to satisfaction of Architect.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Fluid applied paints and coatings. Upon completion of Work, all visible interior and exterior surfaces, within the Contract limits shall be painted unless scheduled "Not to Be Painted in this Section."
 - 1. Each paint system includes:
 - a. Surface preparation, including touch-up of shop applied primers, if needed.
 - b. Prime coat application, where scheduled as part of finish system.
 - c. Finish coat application, where scheduled apply two or more finish coats.
 - 2. Paint semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines, behind wall-mounted items).
- B. Surfaces Not to be Painted:
 - 1. Prefinished wall, ceiling, and floor coverings.
 - 2. Items with factory-applied final finish .
 - 3. Concealed ducts, pipes, and conduit.
 - 4. Glass, plastic laminate, ceramic tile, anodized aluminum.
 - 5. Surfaces of steel items that will be embedded in concrete.
 - 6. Surfaces specifically scheduled or noted on the Drawings not to be painted.
 - 7. Fire-Rating labels on doors and frames.
 - 8. Performance labels on doors and frames.
- C. Related Sections:
 - 1. Section 01 35 42, CALGreen Requirements.
 - 2. Section 09 06 00, Schedules for Finishes.

1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM International - American Society for Testing and Materials
 - 1. ASTM D 4442 - Direct Moisture Content Measurement of Wood and Wood-Base Materials.
 - 2. ASTM D 4444 - Use and Calibration of Hand-Held Moisture Meters.
 - 3. ASTM D 6386 - Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
- C. California Green Building Standards Code, CALGreen 2016.
- D. AQMD - Air Quality Management District: AQMD Regulations - Local Regulations
- E. SDAPCD - San Diego County Air Pollution Control District, Regulation IV.

- F. SSPC - Steel Structures Painting Council.

1.03 SUBMITTALS

- A. CALGreen Submittals:
 - 1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.06.A.
- B. Product Data: For each paint system product and accessory item.
- C. Samples: Of each specified finish system color, texture, and sheen; samples shall be minimum 8-1/2 by 11 inches in size.
 - 1. Prepare transparent wood finish samples on type and quality of wood specified.
- D. Certified copies of moisture test results.
- E. Informational Submittals:
 - 1. Statement of Qualifications from manufacturer.
 - 2. Statement of Qualifications from installer.
 - 3. Manufacturer's application instructions.
- F. Closeout Submittals
 - 1. Material Safety Data Sheets.
- G. Submit Qualifications data for manufacturer and applicator required under Quality Assurance.

1.04 MAINTENANCE MATERIALS AND SUBMITTALS

- A. For each color, type, and gloss of paint used in the work provide, as Extra Materials, a quantity equal to approximately 10 percent of the quantity required for its installation rounded to the nearest gallon, or five gallons, whichever is less.
 - 1. Extra Materials shall be from the same production run as installed materials.
 - 2. Label each container with locations and dates of related installations; do not obscure manufacturer's label.
 - 3. Deliver Extra Materials to Site as directed by Owner.

1.05 QUALITY ASSURANCE

- A. California Green Building Standards Code, CALGreen 2016.
 - 1. Adhesives, sealants, primers and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
 - 2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.
- B. Manufacturer's Qualifications: Company with minimum 10-years' experience manufacturing quality paint and finish products for commercial projects similar in scale and complexity to those required for this Project.

- C. Applicator Qualifications: Company with minimum 5-years' experience painting and finishing commercial projects similar in scale and complexity to those required for this Project.
- D. Materials, for each paint system, shall be by, or as recommended by, a single coating manufacturer for use together in commercial quality paint / coating system for the substrate and exposure conditions indicated.
- E. Regulatory Requirements
 - 1. Conform to AQMD Regulations for maximum VOC limits. Conform to SCAQMD-1113 for maximum VOC limits, copies of Rule 1113 are available at Architect's office
 - 2. Comply with applicable codes and regulations of authorities having jurisdiction including those with jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.
- F. Field Samples: Provide Field Sample of each finish system color, texture, and sheen scheduled. Do not proceed with coating application until sample panel has been approved.
 - 1. Field Sample shall be full height of wall by 10-feet.
 - 2. Locate as approved by Architect.
 - 3. Adjust materials and methods of installation as required to obtain Architect's approval.
 - 4. Document materials and methods used to obtain Architect's approval and maintain at least one copy of this documentation on site while related work is in progress.
 - 5. Maintain access to and protect Field Sample from damage while related work is in progress.
 - 6. Upon acceptance of related work, approved sample may remain as part of Work.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in their original, sealed, undamaged containers with labels intact and legible.
 - 1. Labels shall include manufacturer's name, type of paint, brand name, brand code, color designation, recommended surface preparation, typical coverage, drying times, cleanup procedures, and instructions for mixing and reducing, if permitted.
- B. Store paint materials ambient temperatures between 45- and 90-degrees F, in well ventilated area unless permitted otherwise by manufacturer's instructions.
- C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.07 FIELD CONDITIONS

- A. Supply continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45-degrees F for 24-hours before, during and 48-hours after application of finishes, unless permitted otherwise by manufacturer's instructions.

- B. Do not apply exterior coatings during rain, or when relative humidity is above 50 percent, unless permitted otherwise by manufacturer's instructions.
- C. Minimum application temperatures for Latex Paints: 45-degrees F for interiors; 50-degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum application temperature for Varnish and Transparent Finishes: 65-degrees F for interior or exterior, unless permitted otherwise by manufacturer's instructions.
- E. Maintain lighting level sufficient to conduct painting operations.

1.08 GUARANTEE

- A. Guarantee the painting Work against peeling, fading, cracking, blistering or crazing for a period of two years from the Date of Certified Completion for painting of new surfaces and existing surfaces.

PART 2 - PRODUCTS

2.01 PAINTS AND COATINGS

- A. Acceptable Manufacturers: Products of following manufacturers form basis for design and quality intended.
 - 1. Sherwin-Williams Company, Cleveland, OH.
 - 2. Tnemec Company Inc., Kansas City, MO.
 - 3. Matthews Paint Company, Delaware, OH. Signage Paints.
- B. Or equal, approved in accordance with Division 01, General Requirements, for substitutions.

2.02 MATERIALS

- A. Coatings: Ready mixed, except field-catalyzed coatings. Process pigments to soft past consistency, capable of being readily and uniformly dispersed to homogenous coating.
- B. Colors and Glosses: As scheduled in Section 09 06 00. Architect will select color and hue to be used in various types of paint specified and will be sole judge of acceptability of various glosses obtained from materials proposed to be used in Work. During actual painting, Architect may make minor modifications in tone and shade to adjust for actual surface and lighting conditions encountered.
- C. Undercoats and Thinners: Provide undercoat paint produced by same manufacturer as finish coat. Use only thinners recommended by paint manufacturer and use only to recommended limits. Use undercoat, finish coat and thinner material as parts of a unified system of paint finish.
- D. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.

- E. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified of commercial quality.

2.03 APPLICATION EQUIPMENT

- A. For application of the approved paint, use only such equipment as is recommended by the manufacturer.
- B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by the use of the proposed application equipment.

2.04 FINISHES

- A. Refer to schedule at end of Section for surface finish and **Section 09 06 00**. Notwithstanding product numbers listed in schedule, Contractor shall conform to most recent product numbers as published by the manufacturer.
- B. Refer to Section 09 24 00 for pigmented plaster. Prime coat color shall be approved by Architect prior to application. Color shall approximate color of pigmented plaster as determined and approved by Architect.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.
- C. Measure moisture content of new surfaces using an electronic moisture meter. Apply finishes only when moisture content of surfaces are below the following maximums. Conduct moisture measurements in presence of the project inspector, document readings and submit to Architect under Part 1.
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Located Wood: 15 percent, measured in accordance with ASTM D 4442 and ASTM D 4444.
- D. Beginning installation means acceptance of existing surfaces and conditions.

3.02 MATERIALS PREPARATION

- A. Mix and prepare painting material in accordance with manufacturer's recommendations.
- B. Store materials not in actual use in tightly covered containers.

- C. Maintain containers used in storage, mixing and application of paint in a clean condition, free from foreign materials and residue.
- D. Stir all materials before application to produce a mixture of uniform density and as required during the application of materials. Do not stir into the material any film that may form on the surface. Remove the film and strain the material before using.

3.03 SURFACE PREPARATION

- A. Remove electrical plates, hardware, light fixture trim and fittings prior to preparing surfaces for finishing.
- B. Correct minor defects and clean surfaces which affect Work of this section.
- C. Shellac and seal marks that may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Insulated Coverings: Remove dirt, grease and oil from canvas and cotton.
- F. Gypsum Board Surfaces: Fill minor defects, joints and nail head depressions with spackling compounds. Prime in accordance with primer manufacturer's recommendations. Apply primer over skim coat for Level 5 finish.
- G. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish. Remove dirt, loose mortar, scale, salt or alkali powder and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering or corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
 - 1. Concrete Floors: etch existing concrete bare floors with 5% Muriatic Acid solution where scheduled to be painted.
- H. Plaster Surfaces: Fill hairline cracks, small holes and imperfections with patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- I. Surface Preparation for Exterior Metal (Except Galvanized): Preparation in accordance with SSPC-6 Commercial Blast Cleaning.
- J. Galvanized Surfaces:
 - 1. Prepare galvanized steel and nonferrous metal surfaces in accordance with ASTM D 6386-Surface Preparation of Galvanized Surfaces and manufacturer's instructions.
 - 2. Ensure surfaces are dry.
 - 3. Interior Exposure (Dry/Benign): Remove visible, oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or manufacturer's instructions as specified for coating system. Hand or Power tool clean to remove all insoluble contaminants.

4. Interior and Exterior Exposure (moderate to severe): Remove visible oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or manufacturer's instructions as specified for coating system. Follow initial cleaning with one of the following Methods:
 - a. SURFACE PREPARATION METHOD A (Preferred): Thoroughly roughen the entire surface to be coated using compressed air brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1-2 mils. reference ASTM D 6386-99 (2005) Section 5.4.1.
 - b. SURFACE PREPARATION METHOD B (Alternative method when Method A is not feasible): Chemically Treat with one of the following products to etch the galvanized surface to be coated: Henkel Galvaprep 5 or Clean & Etch by Great Lakes Laboratory. Reference ASTM D 6386-99 (2005) Section 5.4.2.
 - K. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime paint after repairs with Tnemec Series L69 Hi Build Epoxoline II or Carboline 890 VOC or approved in accordance with Division 01, General Requirements for Substitutions.
 - L. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Spot prime bare steel surfaces to match existing primer.
 - M. Wood Doors and Cabinet Work schedules for field-applied transparent or solid stain finish:
 1. Sand surfaces thoroughly with a 5/0, 180 grit sandpaper.
 2. Apply coatings as specified in the schedule to all surfaces, sides and edges. Avoid streaking or uneven application. Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail or screw holes, or other surfaces imperfections.
 3. Stains as selected by Architect from manufacturer's full range of colors.
 4. Provide satin finish for final coats.
 - N. Door and Window Frames, Side Lights, Jambs and Headers: clean and light sand smooth.
- 3.04 PROTECTION
- A. Protect elements surrounding the Work of this Section from damage or disfiguration.
 - B. Repair damage to other surfaces caused by Work of this Section.
 - C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.
 - D. Remove empty paint containers from site.

3.05 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish. Number of coats specified is a minimum. Additional coats shall be applied at no extra cost, if coatings show evidence of uneven application, uneven pigmentation, brush strokes or otherwise unsatisfactory distribution of material.
- D. Under coats shall be lighter and brighter in tint than finish coat.
- E. Sand lightly between coats to achieve required finish.
- F. Allow applied coat to dry before next coat is applied.
- G. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- H. Prime back surfaces of interior and exterior woodwork with primer paint.
- I. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with floss varnish reduced 25 percent with mineral spirits.
- J. Seal tops, bottoms and cutouts for hardware and accessories of wood doors and plastic-laminate covered doors.
- K. Paint Frames: Split paint door frames to match color of walls on each side of opening unless directed otherwise by Architect.
- L. Exterior fascia, trims, reveals, and ornamental fences and gates shall receive accent paint colors different from field paint color.
- M. Paint finish shall continue through behind all wall-mounted items (e.g. markerboards, chalk and tack boards).

3.06 CLEANING

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

3.07 FINISH SYSTEM SCHEDULE - EXTERIOR EXPOSURE

Sherwin-
Williams

-
- A. Cement Plaster, CMU, Concrete - Satin Finish - Acrylic
 1. Primer, 1 Coat B25W00025
 2. Finish, 2 Coats A82W00151
- B. Cement Plaster - Elastomeric
 1. Primer, 1 Coat 4600 436 W305 B25W25 247 6001
 2. Finish, 2 Coats 500 68 W370 Sonneborn 1128 2260
 Soletex Color Flex
- C. Ferrous -Semi-Gloss - Acrylic
 1. Primer, 1 Coat B66W310
 2. Finish, 1 Coat A41WQ8051
- D. Ferrous - Factory Primed. If shop primer is compatible with finish materials, clean and touch-up prime coat in lieu of full primer coat then apply paint finish as specified.
- E. Galvanized Steel and Aluminum - Semi-Gloss - Acrylic
 1. Surface Prep Jasco
 P&P
 2. Primer, 1 Coat B66-310
 3. Finish, 2 Coats B31WJ8651
- 3.08 FINISH SYSTEM SCHEDULE - INTERIOR SURFACES

Sherwin-
Williams

-
- A. Gypsum Board - Eggshell - Acrylic (Skim Coat required for Level 5 finish)
 1. Primer, 1 Coat B11W00500
 2. Finish, 2 Coats B20W00651
- B. Ferrous - Semi-Gloss - Acrylic
 1. Primer, 1 Coat B66W310
 2. Finish, 1 Coat A41WQ8051
- C. Ferrous - Factory Primed. If shop primer is compatible with scheduled finish, clean and touch-up prime coat then apply Finish as scheduled.
- D. Galvanized and Aluminum - Semi-Gloss - Acrylic
 1. Surface Prep SSPC- Jasco Devprep
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 2. Primer, 1 Coat B66-310 5725 4020
 3. Finish, 2 Coats B31WJ8651 5885

3.09 SPECIAL COATING SYSTEMS

- A. Special Coatings: Exterior; metal handrails railings, guardrails, trash and equipment enclosures, roof hatches, ladders scheduled items in Section 05 50 00, Metal Fabrications. Total 5.0 to 8.5 mil thickness, as recommended by the manufacturer. Paint railing or handrails only where scheduled.

		Tnemec	Sherwin-Williams
1.	Unprimed or shop primed - Ferrous - Semi-Gloss - Polyurethane		
a.	Primer, 1 Coat	L69	B58W00610
b.	Finish, 2 Coats	1080	B65W651
2.	Galvanized or Aluminum - Gloss - Polyurethane		
a.	Primer, 1 Coat	L69	B58-620
b.	Finish, 2 Coats	1080	B65-625
3.	Galvanized or Aluminum - Semi-Gloss - Polyurethane		
a.	Primer, 1 Coat	L69	B58-620
b.	Finish, 2 Coats	1081	B65-625

- B. Galvanized Metal, Surface Preparation: SSPC-SP1, Solvent Wash, and etch with one of the following:
1. Sherwin-Williams, GLL Clean N Etch
 2. Dunn-Edwards, Galva-Etch (GE123)
 3. Vista: Krud Kutter Metal Etch
 4. Devoe, Devprep 88
 5. Or equal
 - a.

END OF SECTION

SECTION 11 68 45

SCOREBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Scoreboard.
- B. Sports Video Display.
- C. Stadium Sound System.
- D. Control System.
- E. Scoring Console.
- F. Identification and Sponsor Signage.
- G. Service and support.
- H. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete.
 - 2. Section 05 12 00 - Structural Steel Framing.
 - 3. Division 26 and 27.

1.02 REFERENCES

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ASTM A 36 - Standard Specification for Carbon Structural Steel.
- C. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- D. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- E. ASTM C 33 - Standard Specification for Concrete Aggregates.
- F. ASTM C 150 - Standard Specification for Portland Cement.

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- G. California Building Code.
- H. California Electrical Code.

1.03 PERFORMANCE REQUIREMENTS

- A. Scoreboard, display and other electrical components shall be certified for use in the United States to the UL standards.

1.04 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Operation and maintenance data.
 - 5. Product data for scoreboards, controls, displays and accessories.
- C. Shop Drawings: Submit plan, section, elevation, and perspective view details as necessary to depict proper field fabrication and installation, and provide details on connections, terminations and joints.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors.

1.05 QUALITY ASSURANCE

- A. Confirm all specifications with the factory prior to order.
- B. Single Source Responsibility: Single supplier shall provide all components required to install the products specified in this section.
- C. Manufacturers Qualifications: Company specializing in manufacturing electronic scoreboards and video display systems with 10 years minimum successful experience and maintaining a factory authorized service office/warehouse within 200 miles of the stadium.
- D. Installer Qualifications: Factory-trained and experienced specializing in installing and adjusting equipment with a minimum of five years of DSA experience approved by the manufacturer. Contractor shall provide at least one person who will act in the capacity as the Project Construction Manager and who shall be present at all times during execution of this portion of the Work, who shall be thoroughly familiar with the type of materials being installed and the proper materials and methods.
- E. Welders: AWS certified.

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1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Physical inspection of items required at time of delivery; any shipping damages must be reported at delivery prior to storage.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

- A. Work shall commence only after associated trade work has been sufficiently completed and will not interfere with the installation of the equipment specified in this section.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

- A. Provide manufacturer's standard warranty affirming that products specified in this section shall be free from defects in material and workmanship under normal use provided they are installed in accordance with all current application requirements.
 - 1. Duration and scope: Five (5) years.
- B. Provide on-site service warranty covering parts and labor.
 - 1. Duration and scope: One (5) years.

1.09 EXTRA MATERIALS

- A. Contractor is responsible for providing all hardware, sealants, welding materials and other secondary installation products required for installation. Architect shall approve each product before or during the pre-installation conference.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Nevco Sports which is located at: 300 E. Harris Ave.; Greenville, IL 62246. Phone: (800) 851-4040. Local Sales Representation and Service Provider: CSM Sales LLC and ABV Scoreboard Services Inc., (805) 389-3403.

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- B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 SCOREBOARD:

- A. Basis-Of-Design: Custom Model 3615-ETN Soccer Scoreboard – No left corner digit.
 - 1. Dimensions: 24' Wide x 8' High x 8" Deep.
 - 2. Scoreboard Color: #76 Print Black.
 - 3. Digit Color: Amber.
 - 4. Electronic Programmable Team Names Color: Amber.
 - 5. Scoreboard Logo: 51.5" Wide x 43" High on face of scoreboard.
 - a. Logo to be supplied by Owner.

2.03 SPORTS VIDEO DISPLAY

- A. Wide-angle, Full-Color Sports Displays
 - 1. Pixel resolution: 16mm physical pixel resolution.
 - 2. No less than 270 pixels in height and 420 pixels in length.
 - 3. Minimum Active Display Area: 22.05 feet wide by 14.62 feet tall.
 - 4. Color capability: Minimum 550 billion colors.
 - 5. Frame speed: At or greater than 60 frames per second.
 - 6. Display intensity: Adjustable to 32 levels).
 - 7. Minimum brightness: 7000 nits.
 - 8. Operating temperature: -40 degrees F – 150 degrees F
 - 9. Viewing angle: 140 Horizontal, 60 Vertical.
 - 10. Contrast ratio: Minimum 2000: 1
 - 11. Refresh rate shall be greater than 2400+Hz.
 - 12. LED life expectancy: Minimum of 100,000 hours.
 - 13. Service accessibility for all components shall be from the front.
 - 14. Must include redundant power and signal capability.
 - 15. Display face: Includes low-glare features to optimize display contrast.

2.04 STADIUM SOUND SYSTEM

- A. Model SP (Stadium Pro) 1000
 - 1. Speaker Cabinet Dimensions: 9' Wide x 4' High.
 - a. Speakers (2) / Subwoofer (1)
 - 2. Scrim Size: 100.5" Wide x 36.5" High.
 - 3. Printable Scrim Area: 97" Wide x 33" High.
 - 4. Scrim Color: #76 Print Black.
 - 5. Imprint Color: Blue/Gray/Black.
 - 6. Power Amplifiers (2)
 - 7. Power Sequencer (1)
 - 8. Equipment Rack: 1-14 Space
 - 9. 12 Channel Mixer
 - 10. Announcer Mic With Stand

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2.05 CONTROL ROOM EQUIPMENT

- A. Model HS-1300 Mobile Studio.
 - 1. 6-input mobile studio with built-in HD switcher that accepts choices of input boards for HDMI and HD-SDI
 - a. Includes built-in 17.3" monitor.
 - b. 2 each remote control PTZ cameras.
 - c. Instant Replay with dual monitors.
 - d. Live streaming and recording.
 - e. Built-in transitions and animations.
 - f. Picture-In-Picture capability.
 - g. Hard plastic protective mobile cases.
 - h. All equipment to be portable and light enough to be hand-carried in and out on game day.
- B. Display Director Video Display Software.
 - 1. WINDOWS® based video control software and laptop PC for creating and modifying messages, animations, photos, pre-recorded video and live content on large full color video displays.
 - a. Animate at up to 60 frames per second.
 - b. Supports most standard computer graphics file types (.bmp, .jpeg, .gif, .avi, mpg, mov, etc).
 - c. Message scheduling.
 - d. Include ability to control, prioritize and change graphic layouts and messages on multiple signs while allowing the user to toggle between tasks.
 - e. Include ability to allow broadcasting of live or recorded video feeds in real time.
 - f. Split displays into multiple zones for simultaneous messaging and scoring.
 - g. Sports templates for Football, Soccer, Track and Lacrosse.
 - h. Includes FinishLynx track timing interface.
 - i. Includes 15 hours of custom animation creative services provided by Hype Creative Services.
 - j. Includes standard library of animations and graphics.
- C. OD-50DVC Outdoor Enclosure:
 - 1. Weather Proof Lockable Outdoor Enclosure Box to house Display Director Server, SP-1000 Sound System Controls and DDB T-20 AC Unit. (DDB-T20 to be included).
- D. GRR-10PL-US-10U Portable Equipment Rack to house Video Display Control system and hardware. Manufactured of light-weight construction. Front and rear rack rails. Master ON/OFF switch with indicator light. Locking lids.

2.06 SCORING CONSOLE

- A. Nevco MPCW-7 Controller
 - 1. Capable of scoring multiple sports including football, soccer and lacrosse.

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2. Include remote hand switch for game clock control.
3. Integrates with Display Director Software and PC.

2.07 IDENTIFICATION SIGNAGE

- A. Architectural Elements and Decorative Work:
 1. Provide custom decorative arched truss sign mounted on top of video display as shown on drawings. Include filler panels on sides of video display as shown on drawings.

2.08 SPARE PARTS

- A. Supply a parts inventory containing no less than of 3% spare parts for LED modules, cables and power supplies. Note: All LED modules must come from the same BIN Code as the equipment supplied.
 1. Manufacturer of the LED display components shall continue to make all parts necessary for the continued functioning of the system for a minimum of ten (10) years after acceptance of this project.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Beginning installation means acceptance of existing surfaces and conditions.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended to achieve the best result based on project conditions.

3.03 INSTALLATION

- A. All power and electrical cables to scoreboards and displays will be routed in conduit, power to the scoreboard/display as well as raceways shown on electrical plans by the Electrical Contractor. Scoreboard control wiring will be the responsibility of contractor assigned the scoreboard equipment.
- B. Install scoreboards and exterior displays to beams in location detailed and in accordance with manufacturer's instruction. Verify unit is plumb and level.

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- C. Follow manufacturer's current application requirements for installation under conditions specific to the project.
- D. Install all structural steel components in accordance with manufacturers application instructions where specified on the drawings.
- E. Excavate footings for structural supports in depths and diameters as indicated on drawings. Place concrete and reinforcing steel per section 31 63 23. Backfill section Division 31.
- F. All structural steel components shall be in accordance with ASTM A36 or A572.
 - 1. All Tube ends shall be covered with light gauge end caps.
 - 2. All new steel shall be primed and painted with a color approved by the architect.
 - 3. Weld steel using E70XX electrodes. Prime and paint all welds following installation.
 - 4. Unless otherwise specified in the drawings, all welds shall be continuous 1/4" (6mm) fillet welds.
- G. Install all electrical equipment in accordance with all federal, state and local building codes.
- H. Where manufacturer's requirements and building codes are in direct conflict, the more restrictive method of application shall prevail.

3.04 INSTALLATION – CONTROL CENTER

- A. Provide boxes; cover plates and jacks in locations per plans. Control cables to control panels shall be concealed.
- B. Test connect unit to all jacks and check for proper operation of control unit, scoreboard and all features. Leave control unit in carrying and other loose accessories with Owner's designated representative.
- C. Verify earth ground does not exceed 15 ohms.

3.05 INSTRUCTIONS TO OWNER'S PERSONNEL

- A. Instruct Owner's personnel proper operation and maintenance of all systems, equipment and similar items which were provided as part of Work.
- B. Contractor shall provide schedule to Owner for approval for each of instruction periods required. Total hours of training, not less than 1 hour for each additional equipment specified or scheduled.
- C. Instruction sessions will be held in Owner designated area on project site and at Owner's convenience.
- D. Instructors will be qualified by product manufacturer in subject matter presented at training session.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Site furnishings and improvement items applicable to Work and not specified under individual technical sections.

1.02 SUBMITTALS

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

1.03 FIELD MEASUREMENTS

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

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains.

2.02 MATERIALS

- A. Drinking Fountains:
 - 1. Manufacturer: Haws, Sparks, NV, or approved equal.
 - 2. Model: 3612, ADA Stainless Steel Bottle Filler and Double Drinking Fountains.
 - 3. Description: Outdoor, ADA pedestal bottle filler and drinking fountain with a stainless-steel pedestal with matte silver powder-coating, drain cleanout, and 100% lead free. Shall be vandal resistant.
 - 4. Bubbler Head: Polished Chrome-Plated brass bubbler head with integral basin shank.
 - 5. Colors: As selected by Architect.
 - 6. Quantities and Locations: Refer to Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site furnishings, where required.
- B. Install site furnishings level, plumb, true, and securely anchored or positioned at locations indicated on Drawings. Connect drinking fountain to plumbing connections.

3.03 CLEANING

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

END OF SECTION

SECTION 26 01 00

ELECTRICAL GENERAL PROVISIONS

ARTICLE 1 SUMMARY

- 1.1 This Division of the specification outlines the provisions of the contract work to be performed under this Division.
- 1.2 This Section applies to and forms a part of each section of specifications in Division 26 and all work performed under Division 26, 27 and 28.
- 1.3 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under general requirements.
- 1.4 These specifications contain statements which may be more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.
- 1.5 Where the words 'provide' or 'provision' are used, it shall be definitely interpreted as 'furnishing and installing complete in operating condition'. Where the words 'as indicated' or 'as shown' are used, it shall mean as shown on contract drawings.
- 1.6 Where items are specified in the singular, this Division shall provide the quantity as shown on drawings plus any spares or extras mentioned on drawings or specifications. All specified and supplied equipment shall be new.

ARTICLE 2 CONTRACTOR QUALIFICATIONS

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

ARTICLE 3 CODES, PERMITS AND FEES

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

ARTICLE 4 EXAMINATION OF PREMISES

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

ARTICLE 5 STANDARDS

- 5.1 The following standard publications of the latest editions enforced, and supplements thereto shall form a part of these specifications. All electrical work must, as a minimum, be in accordance with these standards.

- 5.1.1 2019 California Electrical Code (CEC), Part 3 Title 24 CCR.
- 5.1.2 National Fire Protection Association.
- 5.1.3 Underwriters' Laboratories, Inc. (UL).
- 5.1.4 Certified Ballast Manufacturers' Association (CBM).
- 5.1.5 National Electrical Manufacturers' Association (NEMA).
- 5.1.6 Institution of Electrical & Electronics Engineers (IEEE).
- 5.1.7 American Society for Testing & Materials (ASTM).
- 5.1.8 National Board of Fire Underwriters (NBFU).
- 5.1.9 National Board of Standards (NBS).
- 5.1.10 American National Standards Institute (ANSI).
- 5.1.11 Insulated Power Cable Engineers Association (IPECS).
- 5.1.12 Electrical Testing Laboratories (ETL).
- 5.1.13 National Electrical Safety Code (NESC).
- 5.1.14 2019 California Building Code (CBC), Part 2, Title 24 CCR.
- 5.1.15 2019 California Fire Code (CFC), Part 9, Title 24, CCR.
- 5.1.16 2019 NFPA 72 with California State Amendments
- 5.1.17 National Electrical Testing Association (NETA), 2010 or most current

ARTICLE 6 DEFINITIONS

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

ARTICLE 7 WORK AND MATERIALS

- 7.1 Unless otherwise specified, all materials must be new and of the best quality. Materials previously incorporated into other projects, salvaged, or refurbished are not considered new. Perform all labor in a thorough and workmanlike manner.
- 7.2 All materials provided under the contract must bear the UL label where normally available. Note that this requirement may be repeated under equipment specifications. In general, such devices as will void the label should be provided in separate enclosures and wired to the labeled unit in proper manner.

ARTICLE 8 SHOP DRAWINGS AND SUBMITTALS

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

ARTICLE 9 EQUIPMENT PURCHASES

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

ARTICLE 10 COOPERATIVE WORK

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

ARTICLE 11 VERIFICATION OF DIMENSIONS

- 11.1 Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions, etc., and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

- 11.2 Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact location, routes, building obstructions, etc. and install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, keep openings and passageways clear, and maintain proper clearances.

ARTICLE 12 CLOSING-IN OF UNINSPECTED WORK

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

ARTICLE 13 EXCAVATION AND BACKFILL

- 13.1 All excavation and backfill shall be in accordance with Division 1 of these specifications and as noted below.
- 13.2 Perform all necessary excavation, shoring, and backfilling required for the proper laying of all conduits inside the building and premises, and outside as may be necessary.
- 13.3 Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms no wider than necessary to provide ample work room. Grade trench bottoms accurately. Machine grade only to the top line of the conduits, doing the remainder by hand. Do not cut any trench near or under footings without first consulting the Architect. All trenches shall be done in accordance with OSHA standards and regulations.
- 13.4 Backfilling shall be done with each layer compacted before another layer is added. No stones or coarse lumps shall be laid directly on a conduit or conduits.
- 13.5 Trenches shall be filled with the specified material. Sod, if any, shall be removed in cut sections and replaced in same manners.
- 13.6 Provide pumps and drainage of all open trenches for purposes of installing electrical duct and wiring.
- 13.7 Perform all backfilling in accordance with the requirements of and under the direction of the Geotechnical Engineer.
- 13.8 Where new underground trenching is required on sites or in any area where existing underground utilities exist, the Contractor shall provide an independent professional utility locating service to locate exact vertical and horizontal locations of all existing utilities. Where existing utilities are found the Contractor shall hand dig those areas to avoid disruption. The Contractor shall be responsible for immediate repairs to existing underground utilities damaged during construction. The Contractor shall repair all existing asphalt, concrete and

landscape surfaces damaged or removed during construction to match their original conditions. Where trenching extends through public streets or roadways, the Contractor shall notify underground service alert in addition to the independent locating service 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133.

ARTICLE 14 CONCRETE

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

ARTICLE 15 ACCESSIBILITY

- 15.1 Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal, or replacement conveniently and accessibly throughout the finished building.
- 15.2 All required access doors or panels in walls and ceilings are to be furnished and installed as part of the work under this Section. Refer to Division 1 of these specifications and as noted below.
- 15.3 Where located in fire rated assemblies, provide doors which match the rating of the assembly and are approved by the jurisdictional authority.
- 15.4 Refer to 'finish schedule' for types of walls and ceilings in each area and the architectural drawings for rated wall construction.
- 15.5 Coordinate work of the various sections to locate specialties requiring accessibility with others to avoid unnecessary duplication of access doors.

ARTICLE 16 FLASHING

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

ARTICLE 17 IDENTIFICATION OF EQUIPMENT

- 17.1 All electrical equipment shall be labeled, tagged, stamped, or otherwise identified in accordance with the following schedules:
 - 17.1.1 General:
 - 17.1.1.1 In general, the installed laminated nameplates as hereinafter called for shall also clearly indicate its use, areas served, circuit identification, voltage and any other useful data.

- 17.1.1.2 All auxiliary systems, including communications, shall be labeled to indicate function.

17.1.2 Lighting and Local Panelboards:

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

17.1.3 Distribution Switchboards and Feeders Sections:

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

17.1.4 Disconnect Switches, Motor Starters and Transformers:

- 17.1.4.1 Identification shall be with white micarta laminated labels and 3/8" high black lettering.

- 17.1.5 All communication system terminal boxes including T.V., telephone/intercom, security, fire alarm, clock, and computer networking shall be provided with white micarta laminated labels and 3/8" high black lettering.

ARTICLE 18 CONSTRUCTION FACILITIES

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

ARTICLE 19 GUARANTEE

- 19.1 Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defect of material and workmanship for one year from date of final acceptance, as outlined in the general conditions.

Replace without charge any material or equipment proven defective during this period. The guarantee shall include performance of equipment under all site conditions, conditions of load, installing any additional items of control and/or protective devices, as required.

ARTICLE 20 PATENTS

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

ARTICLE 21 PLUMBING (DIVISION 22) / HEATING, VENTILATING, AND AIR CONDITIONING (DIVISION 23) / ELECTRICAL – COORDINATION REQUIREMENTS

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

- 21.2 The work under Division 22 and/or Division 23 shall include the following:

- 21.2.1 All motors required by mechanical equipment.

- 21.2.2 All starters for mechanical equipment which are not provided under the electrical division as part of a motor control center or otherwise indicated on the electrical drawings.

- 21.2.3 All wiring interior to packaged equipment furnished as an integral part of the equipment.

- 21.2.4 All control **wiring and conduit** for mechanical control systems.

- 21.2.5 All control systems required by mechanical equipment.

- 21.3 The work under Division 26 shall include the following:

- 21.3.1 All power wiring and conduit; and conduit only for EMS control conductors between each building and the main control panel.

- 21.3.2 Electrical disconnects as shown on the electrical drawings.

- 21.3.3 Starters forming part of a motor control center.

- 21.4 All power wiring and conduit to equipment furnished under Division 22 and/or Division 23 shall be provided under Division 26. Control wiring and conduit,

whether line voltage or low voltage, shall be provided under the division which furnishes the equipment.

- 21.5 Power wiring shall be defined as all wiring between the panelboard switchboard overcurrent device, motor control center starter or switch, and the safety disconnect switch or control panel serving the equipment. Also, the power wiring between safety disconnect switch and the equipment line terminals.
- 21.6 Control wiring shall be defined as all wiring, either line voltage or low voltage, required for the control and interlocking of equipment, including but not limited to wiring to motor control stations, solenoid valves, pressure switches, limit switches, flow switches, thermostats, humidistats, safety devices, smoke detectors, and other components required for the proper operation of the equipment.
- 21.7 All motor starters which are not part of motor control centers and which are required for equipment furnished under this Division shall be furnished and installed by the Division furnishing the equipment and power wiring connected under Division 26. Motor starters and control devices in motor control centers shall be furnished and installed under Division 26.
- 21.8 Division 26 Contractor shall make all final connections of power wiring to equipment furnished under this Division.
- 21.9 Wiring diagrams complete with all connection details shall be furnished under each respective Section.
- 21.10 Motor starters supplied by Plumbing and/or Heating, Ventilating and Air Conditioning shall be fused combination type minimum NEMA Size 1, and conform to appropriate NEMA standards for the service required. Provide NEMA type 3R/12 gasketed enclosures in wet locations. Provide all starters with appropriately sized overload protection and heater strips provided in each phase, hand/off auto switches, a minimum of 2 NO and NC auxiliary contacts as required, and an integral disconnecting means. For ½ horsepower motors and below, when control requirements do not dictate the use of a starter, a manual motor starter switch with overload protection in each phase may be provided. Acceptable manufacturers are Allen Bradley, General Electric, Square D, Furnas and Cutler Hammer.

ARTICLE 22 EQUIPMENT ROUGH-IN

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

ARTICLE 23 OWNER FURNISHED AND OTHER EQUIPMENT

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

ARTICLE 24 EQUIPMENT FINAL CONNECTIONS

- 24.1 Provide all final connections for the following:
 - 24.1.1 All equipment furnished under this Division.
 - 24.1.2 Electrical equipment furnished under other sections of the specification.
 - 24.1.3 Owner furnished equipment as specified under this Division.

ARTICLE 25 INSERTS, ANCHORS, AND MOUNTING SLEEVES

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

ARTICLE 26 SEISMIC ANCHORING

- 26.1 All switchgear and other free-standing electrical equipment or enclosures shall be anchored to the floor and braced at the top of the equipment to the structure. The Contractor shall submit drawings signed by the Contractors registered structural Engineer indicating method of compliance prior installation.
- 26.2 All sound systems, communication, signal or data networking equipment or enclosures shall be anchored to the structure. The Contractor shall submit drawings signed by the Contractors registered Structural Engineer indicating method of compliance prior to installation.

ARTICLE 27 RUST PROOFING

- 27.1 Rust proofing must be applied to all ferrous metals and shall be in accordance with Section 05500 of these specifications and as noted below.

27.1.1 Hot-dipped galvanized shall be applied and after forming of angle-iron, bolts, anchors, etc.

27.1.2 Hot-dipped galvanized coating shall be applied after fabrication for junction boxes and pull boxes cast in concrete.

ARTICLE 28 GENERAL WIRING

28.1 Where located adjacent in walls, outlet boxes shall not be placed back to back, nor shall extension rings be used in place of double boxes, all to limit sound transmission between rooms. Provide short horizontal nipple between adjacent outlet boxes, which shall have depth sufficient to maintain wall coverage in rear by masonry wall.

28.2 In those instances where outlet boxes, recessed terminal boxes, or recessed equipment enclosures are installed in a fire rated assembly, provide "Flamesafe FSD 1077" fire stopping pads or approved equal, over the outlet or box.

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

ARTICLE 29 SEPARATE CONDUIT SYSTEMS

29.1 Each electrical and signal system shall be contained in a separate conduit system as shown on the drawings and as specified herein. This includes each power system, each lighting system, each signal system of whatever nature, telephone, standby system, sound system, control system, fire alarm system, etc.

29.2 Further, each item of building equipment must have its own run of power wiring. Control wiring may be included in properly sized conduit for equipment feeders of #6 AWG and smaller, having separate conduit for larger sizes.

ARTICLE 30 CLEANUP

30.1 In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

30.2 Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.

30.3 During the progress of the work, keep the premises clean and free of debris.

ARTICLE 31 UTILITY SERVICES

31.1 The Division 26 Contractor shall contact the serving utility companies; notify the serving power, telephone and cable TV utilities of the following:

31.1.1 Name and address of Contractor.

31.1.2 Estimated times of construction start, completion and required service connections.

31.1.3 Project service voltage, phase load, and service size.

31.1.4 Provide to the Architect written verification from each utility company indicating their concurrence with the contract documents.

31.2 Contractor shall notify underground service alert 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133. All work shall be in accordance with the Division 1 Sections of these specifications.

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

ARTICLE 32 TEST AND INSPECTION PROCEDURES – EXISTING MEDIUM VOLTAGE, AIR INSULATED, CIRCUIT BREAKER TESTS

32.1 Tests shall be done in accordance with ANSI/NETA Standards and by a contractor certified in medium voltage testing and procedures. Contractor qualifications shall be submitted to the electrical engineer of record for approval.

32.2 Testing shall not be done or scheduled until the outage is scheduled and approved by the owner. Outage shall not exceed 24 hours unless approved by the owner and coordinated with the CM and Architect of Record.

32.3 Visual and Mechanical Inspection

32.3.1 Inspect physical and mechanical condition.

32.3.2 Inspect anchorage, alignment, and grounding.

32.3.3 Verify that all maintenance devices are available for servicing and operating the breaker.

32.3.4 Clean the Unit.

32.3.5 Inspect arc chutes.

32.3.6 Inspect moving and stationary contacts for condition, wear, and alignment.

32.3.7 Close/open breaker and check for binding, friction, contact alignment, contact sequence, and penetration.

32.3.8 Perform all mechanical operation tests on the operating mechanism in accordance with manufacturer's published data.

32.3.9 Inspect bolted electrical connections for high resistance using one of the following methods:

32.3.9.1 Use of a low-resistance ohmmeter in accordance with Section 33.4.

32.3.9.2 Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

32.3.9.3 Perform a thermographic survey in accordance with NETA standards.

32.3.10 Verify cell fit and element alignment.

32.3.11 Verify racking mechanism operation.

32.3.12 Inspect puffer operation.

32.3.13 Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

32.3.14 Record as-found and as-left operation-counter readings.

32.4 Electrical Tests

32.4.1 Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable. See Section 33.3.

32.4.2 Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with the circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data.

32.4.3 Perform a contact/pole-resistance test.

32.4.4 With the breaker in a test position, perform the following tests:

32.4.4.1 Trip and close breaker with the control switch.

32.4.4.2 Trip breaker by operating each of its protective relays. Recalibrate and adjust relay settings based on time current study to be done for the project.

32.4.4.3 Verify mechanism charge, trip-free, and antipump functions.

32.4.4.4 Verify blowout coil circuit continuity.

32.4.4.5 Verify operation of heaters, if applicable.

- 32.4.4.6 Test instrument transformers in accordance with NETA standards.

32.5 Test Values

32.5.1 Test Values – Visual and Mechanical

- 32.5.1.1 Bolt-torque levels should be in accordance with manufacturer's published data.
- 32.5.1.2 Results of the thermographic survey shall be in accordance with NETA standards.
- 32.5.1.3 Compare travel and velocity values to manufacturer's published data.

32.5.2 Test Values – Electrical

- 32.5.2.1 Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- 32.5.2.2 Circuit breaker insulation resistance should be in accordance with manufacturer's published standards.
- 32.5.2.3 Insulation-resistance values of circuit breakers should be in accordance with manufacturer's published data. Values of insulation resistance less than manufacturer's recommendations should be investigated.
- 32.5.2.4 Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate values that deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.
- 32.5.2.5 Breaker mechanism charge, close, open, trip, trip-free, and antipump features shall function as designed.
- 32.5.2.6 Minimum pickup for trip and close coils shall be in accordance with manufacturer's published data.
- 32.5.2.7 Power-factor or dissipation-factor and capacitance values should be within ten percent of nameplate rating for bushings. Hot collar tests are evaluated on a milliampere/milliwatt loss basis, and the results should be compared to values of similar bushings.
- 32.5.2.8 If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the over

potential test, the circuit breaker is considered to have passed the test.

32.5.2.9 The blowout coil circuit should exhibit continuity.

32.5.2.10 Heaters should be operational.

32.5.2.11 The results of instrument transformer tests shall be in accordance with manufacturer's standards.

ARTICLE 33 PAINTING

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

ARTICLE 34 GENERAL DEMOLITION REQUIREMENTS

34.1 Remove existing work and items which are required to be removed in such manner that minimum damage and disturbance is caused to adjacent and connection work scheduled to remain. Repair or replace existing work schedule.

34.2 Include preparation of existing areas to receive new materials and removal of materials and equipment to alter or repair the existing building as indicated and as specified.

34.3 Perform demolition exercising proper care to prevent injury to the public, workmen and adjoining property.

34.4 Perform the removal, cutting, drilling of existing work with extreme care and use small tools in order not to jeopardize the structural integrity of the building.

34.5 Rebuild to existing condition or better, existing work which has to be removed to allow the installation of new work as required.

34.6 Remove, protect and reinstall existing items as indicated. Replace materials scheduled for reuse which are damaged by the Contractor to the extent that they cannot be reused, with equal quality material, and installation.

34.7 Do not reuse in this project materials and items removed from existing site or building, except with specific written approval by the Architect in each case, unless such removed material or item is specifically indicated or specified to be reused.

34.8 Remove materials and equipment indicated to be salvaged for reinstallation and store to prevent damage and reinstall as the work progresses. Do not reuse in this project, other materials and equipment removed from existing site or building, except with specific written approval by the Architect in each case.

- 34.9 Patch areas requiring patching, including damage caused by removing, relocating or adding fixtures and equipment, damages caused by demolition at adjacent materials.
- 34.10 Do not stockpile debris in the existing building, without the approval of the Architect. Remove debris as it accumulates from removal operations to a legal disposal area.
- 34.11 Contractor to assume existing oil filled and dry transformers, oil switches, ballasts, lamps, wooden poles, cross arms, computers, computer monitors, and conductor insulation containing materials considered hazardous. Comply with local, state and federal regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution. Contractor shall be responsible for removal of the above hazardous materials where encountered. Include all costs for such removal as part of this contract.
- 34.12 All fluorescent, compact fluorescent, high intensity discharge, metal halide, mercury vapor, high and low-pressure sodium, and neon lamps are to be disposed of as required by the California Waste Rule Regulations as described in the California Code of Regulations, Title 22, Division 4.5 and Chapter 23.
- 34.13 **Communication System:** Where new communication systems, (including telephone, intercom, clock, security, fire alarm, data, multimedia, CATV or lighting controls) are installed to replace existing systems, unless where otherwise directed the existing systems shall remain fully operational until the new system has been installed and tested. Demolition of the existing systems shall include removal of all equipment and associated wiring and exposed conduits and providing new blank covers for all abandoned device locations.
- 34.14 **Salvage Power Equipment:** The Contractor shall carefully remove all existing switchboards, panelboards, transformers, and confirm in writing which items the Owner wishes to keep. These items shall be transported to the Owner's maintenance facilities by the Contractor. All remaining items shall be disposed of by the Contractor.
- 34.15 **Salvage Lighting Equipment:** The Contractor shall confirm in writing which items the Owner wishes to keep. These items shall be transported to the Owner's maintenance facilities by the Contractor. All remaining items shall be disposed of by the Contractor.
- 34.16 **Salvage Communication Equipment:** The Contractor shall carefully remove all communication devices (telephone, intercom, clock, security, fire alarm, data, multimedia, CATV or lighting controls) and box each type of devices separately. The Contractor shall deliver all items to the Owner's maintenance facility.

ARTICLE 35 PROJECT CLOSEOUT

- 35.1 Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this Division, in accordance with Division 1 of these specifications and as described below.

35.2 Equipment Lists and Maintenance Manuals:

35.2.1 Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manuals. The equipment list shall include the following items for every piece of material equipment supplied under this Section of the specifications:

35.2.1.1 Name, model, and manufacturer.

35.2.1.2 Complete parts drawings and lists.

35.2.1.3 Local supply for parts and replacement and telephone number.

35.2.1.4 All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.

35.3 Maintenance manuals shall be furnished for each applicable section of the specifications and shall be suitably bound with hard covers and shall include all available manufacturers' operating and maintenance instructions, together with "as-built" drawings to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to the Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address, and phone numbers of all subcontractors involved in any of the work specified herein. Four copies of the maintenance manuals bound in single volumes shall be provided.

ARTICLE 36 RECORD DRAWINGS

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

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

36.3 One set of these record drawings shall be delivered to the Architect. The engineer will review documents for completeness and will not be responsible for editing contractor computer files.

ARTICLE 37 CHANGES AND EXTRA WORK

37.1 When **changes** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:

37.1.1 The material Costs shall **not exceed** the latest edition of the "Trade Service" end column "C" price list. The materials prices may be higher only where the Contractor can produce invoices to substantiate higher material costs. The Contractor shall submit a print out copy of the trade service sheets with the change order to substantiate these values.

37.1.2 The labor Costs shall **not exceed** the latest edition of the "NECA Manual of Labor Units" **normal column**.

37.2 When **credits** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:

37.2.1 The Material Costs shall **not be less than 80% of** the latest edition of the "Trade Service" end column price list. The materials prices may be lower only where the Contractor can produce invoices to substantiate lower material costs. Restocking fees may also be included in this amount where applicable.

37.2.2 The Labor Costs shall **not be less than 80% of** the latest edition of the "NECA Manual of Labor Units" **normal column**.

37.3 Conduit pricing for conduits of all types sized 3" or smaller.

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

37.3.1 Couplings.

37.3.2 Set Screw or Compression Fittings, locknuts, Bushings and washers.

37.3.3 Conduit straps and associated screws or nails.

37.3.4 LB fittings or other specialty fittings or specialty mounting hardware may be included where needed.

37.4 Wire pricing for all types and sizes.

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

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

37.4.1 Locknuts, Bushings, tape, wire markers.

37.5 When changes in the scope of work require other equipment installations such as lighting fixtures, panelboards, switchboards, wiring devices, communications equipment etc. the Contractor shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for these equipment items represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

37.5.1 Associated screws, nails, bolts, anchors or supports.

37.5.2 Locknuts, washers, tape.

37.6 The total labor hours for extra work will be required to be calculated as follows:

37.6.1 Change orders with 1 to 30 total labor hours

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

37.6.2 Change orders with 31 to 100 total labor hours

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

37.6.3 Change orders with over 100 total labor hours

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

37.7 When change orders are issued which allow the work to be completed in the normal sequence of construction, the labor rates shall be based on the most current "Prevailing Wage" – straight time total hourly rate. When change orders require the Contractor to work out of sequence the "Prevailing Wage"– daily overtime hourly rate shall apply. Special condition situations shall be reviewed on an individual basis for alternate hourly rate schedules.

37.8 Costs **will not** be permitted for additional supervision on site or office time for processing any change order other than the 10% overhead allowance as described in Division 1. Cost for special equipment required to install items for an individual change order are permitted and must be individually identified. Lump Sum cost for small tools or any other cost not specifically required for the change order are **not** permitted.

37.9 Contractor estimates shall be formatted to clearly identify each of the following:

37.9.1 Line item description of each type of material or labor item.

37.9.2 Description of quantity for each item.

37.9.3 Description of (material cost per / quantity).

37.9.4 Description of (labor cost per / quantity).

37.9.5 Description of total labor hour breakdown per Foreman, Journeyman or General Laborer as described above.

ARTICLE 38 ELECTRONIC FILES

38.1 The Contractor shall make a **written** request directly to Johnson Consulting Engineers for electronic drawing files. As a part of the written request, please include the following information:

38.1.1 Clearly indicate each drawing sheet needed (i.e., E1.1, E2.1, etc.).

38.1.2 Identify the name, phone number, mailing address and e-mail address of the person to receive the files.

38.1.3 Provide written confirmation and agreement with the requirements described for payment of computer files, as described below.

38.2 Detail or riser diagram sheets, or any other drawings other than floor plans or site plans, **will not be made available to the Contractor.**

38.3 Files will only be provided in the AutoCAD format in which they were created.

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

38.5 CAD files will be made available via e-mail or on disk, depending on the quantity of files requested. The Contractor requesting the files will be required to pay \$50.00 per drawing plan, or \$300.00 maximum, whichever is **less**.

END OF SECTION

SECTION 26 05 19

POWER CONDUCTORS

PART 1 – GENERAL

- 1.1 Furnish and install wire and cable for branch circuits and feeders specified herein and as shown on the electrical drawings.
- 1.2 Submittals: Submit manufacturers' data for the following items:
 - 1.2.1 All cables and terminations
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed

PART 2 – PRODUCTS

- 2.1 Wire and cable Rated 120 volt to 600 volt.
 - 2.1.1 All wire and cable shall be new, 600 volt insulated copper, of types specified below for each application. All wire and cable shall bear the UL label and shall be brought to the job in unbroken packages. Wire insulation shall be the color as specified herein and shall be type THWN-2. Insulated conductors shall be installed in all exterior exposed raceways. Conductors for branch circuit lighting, receptacle, power and miscellaneous systems shall be a minimum of No. 12 AWG. Increase conductor size to No. 10 AWG for 120 volt circuits greater than 100 feet from the panel to the load and for 277 volt circuits greater than 200 feet from the panel to the load. Circuit home-runs indicated to be larger than No. 12 must be increased the entire length of the circuit, including equipment grounding conductor. Wire sizes No. 14 through No. 10 shall be solid. No. 8 and larger shall be stranded.
 - 2.1.2 Aluminum conductors will be permitted (only where specifically identified on the drawings. See "600 Volt Feeder Schedule") in sizes 2/0 or larger. Conductors shall be listed by Underwriters Laboratories (UL) and suitable

for operation at 600 volts or less, at a maximum operating temperature of 90N C maximum in wet or dry locations. Conductors shall be marked "SUN-RES". Aluminum alloy conductors shall be compact stranded conductors of STABILOY® (AA-8030) as manufactured by Alcan Cable or Listed equal. AA-8000 Series aluminum alloy conductor material shall be recognized by The Aluminum Association.

2.1.3 MC type armored cable reference Section 26 05 33.

2.2 Wire and cable for systems below 120 volts.

2.2.1 All low voltage and communications systems cables routed underground shall be provided with a moisture resistant outer jacket, West Penn "Aquaseal" or equal, unless otherwise specified.

PART 3 - EXECUTION

3.1 Wire and cable shall be pulled into conduits without strain using powdered soapstone, mineralac, or other approved lubricant. In no case shall wire be repulled if same has been pulled out of a conduit run for any purpose. No conductor shall be pulled into conduit until conduit system is complete, including junction boxes, pull boxes, etc.

3.2 All connections of wires shall be made as noted below:

3.2.1 Connections to outlets and switches: Wire formed around binding post of screw.

3.2.2 No. 10 wire and smaller: Circuit wiring connections to lighting fixtures and other hard wired equipment shall be made with pressure type solderless connectors, Buchanan, Scotchlock, Wing Nut, or approved equal. Alternate "WAGO" #773 series or "IDEAL" #32, 33, 34 and 39 series push wire style connectors are also acceptable.

3.3 All wiring shall be continuous without splicing unless where specifically noted on the drawings or where permitted below.

3.3.1 No. 10 wire and smaller above grade: Quantities as needed, connection made with pressure type solderless connectors, Scotchlock or equal.

3.3.2 No. 10 wire and smaller below grade: Quantities as needed, connection made with 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.3 No. 8 wire and larger above grade: Quantities only where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate

products must be UL listed for direct burial/submersible and rated to (1000V).

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

- 3.4 All wiring throughout shall be color coded as follows:

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

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

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 – GENERAL

- 1.1 Furnish and install grounding and grounding conductors and electrodes as specified herein and as shown on the drawings.
- 1.2 Submit catalog data for all components.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – EXECUTION

- 2.1 Grounding
 - 2.1.1 All panelboard cabinets, equipment, enclosures, and complete conduit system shall be grounded securely in accordance with pertinent sections of CEC Article 250. Conductors shall be copper. All electrically operated equipment shall be bonded to the grounded conduit system. All non-current carrying conductive surfaces that are likely to become energized and subject to personal contact shall be grounded by one or more of the methods detailed in CEC Article 250. All ground connections shall have clean contact surfaces. Install all grounding conductors in conduit and make connections readily accessible for inspection.
 - 2.1.2 Provide an insulated equipment grounding conductor in all branch circuit and feeder raceway systems, sized in accordance with CEC 250-1122.
 - 2.1.3 Provide an additional individual insulated grounding conductor for each circuit which contains an isolated ground receptacle or surge suppression receptacle.
 - 2.1.4 Grounding of metal raceways shall be assured by means of provisions of grounding bushings on feeder conduit terminations at the panelboard,

and by means of insulated continuous stranded copper grounding wire extended from the ground bus in the panelboard to the conduit grounding bushings.

2.1.5 Except for connections which access for periodic testing is required, make grounding connections which are buried or otherwise inaccessible by exothermite type process.

2.1.6 The following ohmic values shall be test certified for each item listed. A written report signed and witnessed by the project IOR shall be provided to the engineer. If the ohmic value listed cannot be obtained additional grounding shall be installed to reach the value listed.

2.1.6.1 Service.10 ohms.

2.1.6.2 Step down transformers and non-current carrying metal parts
. 25 ohms.

2.1.6.3 Manholes, handholes, etc.
. 10 ohms.

END OF SECTION

SECTION 26 05 33

CONDUIT AND FITTINGS

PART 1 – GENERAL

- 1.1 Furnish and install conduit and fittings as shown on the drawings and as specified herein.
- 1.2 Submit Manufacturer's data on the following:
 - 1.2.1 Conduit.
 - 1.2.2 Fittings
 - 1.2.3 Fire stopping Material.
 - 1.2.4 Surface Raceways.
 - 1.2.5 Type MC or MC-PCS cable, provide construction details and UL "E" number.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Rigid steel conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT) and flexible metallic conduit shall be steel, hot dipped galvanized after fabrication.
- 2.2 PVC conduit shall be Carlon or approved equal.
- 2.3 Liquid tight flexible metal conduit shall be Anaconda Sealtite type UA or approved equal. Fittings shall be Appleton, Crouse-Hinds, Steel City, T&B, or equivalent.

- 2.4 MC type armored cable, when utilized, shall be provided with the following:
 - 2.4.1 Comply with UL 1479 and CEC 330
 - 2.4.2 90°C, copper, THHN conductors.
 - 2.4.3 Minimum #12 insulated grounding conductor.
 - 2.4.4 Conductors sized No. 10 and smaller shall be solid, No. 8 and larger shall be stranded.
 - 2.4.5 Oversized (150%) neutrals or separate neutrals shall be provided.
 - 2.4.6 Increase phase conductors to No. 10 AWG for 120 volt circuits greater than 100 feet from panel to load and for 277 volt circuits greater than 200 feet from panel to load. Where required increase conductor sizes for entire length of circuit.
 - 2.4.7 Interlocked armored aluminum sheath.
 - 2.4.8 AC or BX type armored cable shall not be substituted in lieu of MC type cable.
 - 2.4.9 Color code cable according to cable type and configuration.
 - 2.4.10 Acceptable manufacturers are AFC and Alfex.
- 2.5 MC-PCS luminary armored cable , when utilized, shall be provided with the following:
 - 2.5.1 Comply with UL 1479 and CEC 330
 - 2.5.2 90°C, copper, THHN conductors.
 - 2.5.3 Minimum #12 insulated grounding conductor.
 - 2.5.4 Lighting phase conductors sized No. 10 and smaller shall be solid, lighting control conductors shall be sized no. 16 solid.
 - 2.5.5 Interlocked armored aluminum sheath.
 - 2.5.6 AC or BX type armored cable shall not be substituted in lieu of MC type cable.
 - 2.5.7 Color code phase cable according to cable type and configuration. color code control conductors purple/gray.
 - 2.5.8 Acceptable manufacturers are AFC and Alfex.
- 2.6 Fire stopping material shall provide an effective seal against fire, heat, smoke and fire gases. Fire stopping material shall be tested to comply with ASTM E 814

and UL 1479. The submittal for this product shall include the UL listed system number and installation requirements for each type of penetration seal required for this project.

- 2.7 Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the UL label.
- 2.8 All plastic conduit shall be rigid, schedule 40, heavy wall PVC. All PVC conduit shall be UL listed. Underground utility company conduits shall comply with local utility co. requirements.
- 2.9 Plastic conduit shall be stored on a flat surface, and protected from the direct rays of the sun.
- 2.10 Where branch circuit or communication raceways cannot be concealed in ceilings or walls and are required to be exposed in interior spaces, provide nonmetallic surface raceway system sized per the manufacturer capacity requirements. A full complement of nonmetallic fittings must be available and matching device boxes and cover plates must be provided. The color of the raceway system, components and boxes shall be (white). Where data networking cabling is to be installed, all raceway fittings shall meet Category 5 radius requirements. Where specific raceway types have been noted on the drawings they shall be as follows:

2.10.1 System 'SR'	Hubbell Wiremold Panduit Hellerman-Tyton	WALLTRAK 1 series ECLIPSE PN05series LD5 series TSR2 series
2.10.2 System 'SR2'	Hubbell Wiremold Panduit Hellerman-Tyton	WALTRAK 22 2300D Series D2P10 TSR3 series
2.10.3 System 'SR3'	Hubbell Wiremold Panduit Hellerman-Tyton	BASETRAK series 5400 - series 70 series MCR Infostream" series

Provide with offset boxes, inline boxes may only be used where specifically shown on the drawings.

PART 3 – FITTINGS

- 3.1 All metallic fittings, including those for EMT, flexible conduit, or malleable iron. Die cast fittings of any other material are not permitted.
- 3.2 Locknuts shall be steel or malleable iron with sharp clean cut threads.
- 3.3 Entrance seals shall be 0.Z. type FSK or equivalent.

- 3.4 Bushings and locknuts: Where conduits enter boxes, panels, cabinets, etc., they shall be rigidly clamped to the box by locknuts on the outside, and a lock nut and plastic bushing on the inside of the box. All conduits shall enter the box squarely.
- 3.5 Furnish and install insulated bushings as per CEC article No. 300 - 4 (F) on all conduits. The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.
- 3.6 Transition from plastic to steel conduits shall be with PVC female threaded adaptors.
- 3.7 Couplings and connectors for rigid steel or IMC conduit must be threaded, or compression type (set screw fittings are not permitted).
- 3.8 Couplings and connectors for EMT shall be compression, watertight. Set screw connectors are not acceptable, except for systems below 120 volts.
- 3.9 MC or MC-PCS type armored cable shall be provided with listed clamp type die cast zinc set screw connectors. Anti-short bushings shall be provided at all cable ends.
- 3.10 Connectors for flexible metal conduit shall be steel or malleable iron with screw provided to clinch the conduit into the adapter body. For sizes up to $\frac{3}{4}$ " a screw-in, "Jake type," fitting may be used.
- 3.11 Install approved expansion fittings, or liquid tight flex conduit with a minimum 6" slack for conduits passing through all expansion and seismic joints.

PART 4 - EXECUTION

- 4.1 All branch circuits shall be installed concealed in walls or above ceilings or in concrete floor slabs. PVC conduits installed in concrete floor slabs shall transition to PVC coated rigid steel where conduits penetrate above finished grade or finished floor.
- 4.2 Conduit sizes for various numbers and sizes of wire shall be as required by the CEC, but not smaller than $\frac{1}{2}$ " for power wiring and $\frac{3}{4}$ " for communications and fire alarm systems unless otherwise noted. Conduit in slab or below grade shall be $\frac{3}{4}$ " minimum trade size, unless otherwise identified.
- 4.3 Conduit size shall be such that the required number and sizes of wires can be easily pulled in and the Contractor shall be responsible for the selection of the conduit sizes to facilitate the ease of pulling. Conduit sizes shown on the drawings are minimum sizes in accordance with appropriate tables in the CEC. If because of bends or elbows a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.
- 4.4 The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the job. When conduit becomes bent or holes are punched through same, or outlets moved after being roughed-in, the Contractor shall replace same, without additional cost to the Owner.

- 4.5 Rigid steel conduit or IMC shall be used as follows:
 - 4.5.1 Exposed exterior locations.
 - 4.5.2 Exposed interior locations below eight feet above floor, except in electrical rooms and closets.
 - 4.5.3 In hazardous or classified areas as required by CEC.
- 4.6 EMT conduit shall be used for areas as follows:
 - 4.6.1 All interior communications, signal, and data networking systems.
 - 4.6.2 All interior power wiring systems where not required to be in rigid steel, IMC or flexible conduit.
- 4.7 Flexible conduit shall be used for areas as follows:
 - 4.7.1 To connect motors, transformers, and other equipment subjected to vibration or where specifically detailed on the drawings.
 - 4.7.2 Flexible conduit shall not be used to replace EMT in other locations where the conduit will be exposed.
 - 4.7.3 Flexible metal conduit shall be ferrous. Installation shall be such that considerable slack is realized. The conduit shall contain separate code sized grounding conductor.
 - 4.7.4 Liquid tight flexible conduit shall be used in conformance with CEC in lengths not to exceed 4'. For equipment connections, route the conduit at 90 degrees to the adjacent path for point of connection. The conduit shall contain separate code sized grounding conductor. Use liquid tight flexible conduit for all equipment connections exposed in possible wet, corrosive or oil contaminated areas, e.g., shops and outside areas.
- 4.8 MC armored cable may be used as follows:
 - 4.8.1 All branch circuit wiring for lighting and power circuits where permitted and installed in compliance with UL 1569 and CEC 330.
- 4.9 MC-PCS luminary armored cable may be used as follows:
 - 4.9.1 All Lighting branch circuit wiring for lighting circuits where permitted and installed in compliance with UL 1569 and CEC 300-22(c), 330. This cable permits conductors of control circuits to be placed in a cable with lighting power circuits or class 1 circuits.
 - 4.9.2 It shall not be considered an acceptable option to install lighting control class 1 circuits as an open wire installation.

- 4.10 MC and MC-PCS armored cable shall **not** be used for the following areas:
- 4.10.1 Any exterior, underground or buried in concrete circuits.
 - 4.10.2 Any circuits feeding HVAC equipment or pumps or any circuit with 30 AMPs or greater overcurrent protection.
 - 4.10.3 Any exposed interior locations except in electrical, communication or mechanical equipment rooms.
 - 4.10.4 Any exposed interior damp/wet locations, kitchens, science classrooms, shop areas, or concealed in science classroom casework, unless provided with approved PVC jacket.
 - 4.10.5 Any hazardous rated area.
- 4.11 Plastic conduit shall be used for all exterior underground, in slab, and below slab on grade conduit installations. Install bell ends at all conduit terminations in manholes and pull boxes. Where plastic conduit transitions from below grade to above grade, no plastic conduit shall extend above finished exterior grade, or above interior finished floor level.
- 4.12 Plastic conduit joints shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected. Conduit joint couplings shall be made watertight. Plastic conduit joints shall be made up by brushing a plastic solvent cement on the inside of a plastic fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly.
- 4.13 All underground conduit depths shall be as detailed on the drawings or a minimum of 30" below finished grade (when not specifically detailed otherwise), for all exterior underground conduits. Where concrete slurry or concrete encasement is provided, include "Red" color dye in mixture.
- 4.14 All underground conduits for power systems (600v and higher), shall be concrete encased and a minimum of 48" below grade or as detailed on the drawings. Where concrete slurry or concrete encasement is provided, include "Red" color dye in mixture.
- 4.15 Conduit shall be continuous from outlet to outlet, cabinet or junction box, and shall be so arranged that wire may be pulled in with the minimum practical number of junction boxes.
- 4.16 All conduits shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, electrical closets, and in existing or unfinished spaces. No conduit shall be run exposed in finished areas without the specific approval of the Architect.
- 4.17 All raceways which are not buried or embedded in concrete shall be supported by straps, clamps, or hangers to provide a rigid installation. Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams, or

columns. In no case shall conduit be supported or fastened to other pipes or installed to prevent the ready removal of other trades piping. Wire shall not be used to support conduit.

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

ceilings, they shall be supported by hanger rods and hangers.] Conduits installed exposed in damp locations shall be provided with clamp backs under each conduit clamp, to prevent accumulation of moisture around the conduits.

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

- 4.31 In addition to the above requirements, the following requirements shall apply to all data networking conduits:
- 4.31.1 Flexible metal conduit may only be used where required at building seismic and/or expansion joints.
 - 4.31.2 All underground conduits shall be provided with minimum 24" radius elbows (vertical) and 60" (horizontal).
 - 4.31.3 No length of conduit above grade shall be installed to exceed 150 feet between pull boxes, or points of connection, unless where specifically detailed on the drawings.
 - 4.31.4 No length of conduit shall be installed to exceed two 90 degree bends between pull boxes, or points of connection, unless where specifically detailed on the drawings.
- 4.32 Where surface raceways are installed in interior spaces, the Contractor shall take care to route in straight lines at right angles to or parallel with walls, beams, or columns. All raceways and device boxes shall be securely screwed to the finish surface with zinc screw "Auger" anchors Stk #ZSA1K by Gray Bar Electric or equal. Tape adhesive application will not be permitted.
- 4.33 The Contractor who installs surface raceway systems shall provide and install complete with wire retention clips, one for every (8) vertical feet or (5) horizontal feet or portion thereof. This Contractor shall also provide each raceway channel with pull strings.
- 4.34 It shall be the responsibility of the Contractor installing the raceway to coordinate the installation of raceway device plates and inserts with the communications or data contractors.
- 4.35 MC or MC-PCS cable shall be cut using a specific metallic sheath armor stripping tool. The use of hacksaws, dikes or any other tools not specifically designed to remove the armor sheath will not be permitted.
- 4.36 MC or MC-PCS cables installed in attic spaces or above lay-in ceilings shall be installed to be protected from physical damage. The cable shall be mounted along the sides or bottom of joists, rafters or studs.
- 4.37 Support wires used for supporting ceilings, lighting fixtures or other equipment items shall not be used to support MC or MC-PCS cables. Conduits, duct work, piping or any other equipment shall not be used to support or mount MC cables.
- 4.38 MC or MC-PCS cable supports, fasteners and clips shall be designed specifically for use with MC cables. Standard conduit supports, fasteners and clips, nails or other items are not permitted for installing MC cables.

END OF SECTION

SECTION 26 05 34

OUTLET AND JUNCTION BOXES

PART 1 – GENERAL

- 1.1 Furnish and install electrical wiring boxes as specified and as shown on the electrical drawings.
- 1.2 Submit manufacturer's data for all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

- 2.1 Boxes shall be as manufactured by Steel City, Appleton, Racor, or approved equal.
- 2.2 All boxes must conform to the provisions of Article 370 of the CEC. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Minimum box size shall be 4" square x 1-½" deep.
- 2.3 Boxes generally shall be hot dipped galvanized steel with knockouts. Boxes on exterior surfaces or in damp locations shall be corrosion resistant, cast ferrous alloy and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Boxes shall be Appleton Type FS, Crouse-Hinds, or the approved equal. Conduit bodies shall be corrosion resistant, cast malleable iron. Conduit bodies shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Conduit bodies shall be Appleton Unilets, Crouse-Hinds, or the approved equal. Where recessed, boxes shall have square cut corners.
- 2.4 Deep boxes shall be used in wall covered by wainscot or paneling and in walls or glazed tile, brick, or other masonry which will not be covered with plaster. Through the wall type boxes shall not be used unless specifically called for. All boxes shall be nongangable. Boxes in concrete shall be of a type to allow the placing of conduit without displacing the reinforcing bars. All lighting fixture outlet

boxes shall be equipped with the proper fittings to support and attach a light fixture.

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

PART 3 – EXECUTION

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

END OF SECTION

SECTION 26 05 43

UNDERGROUND PULL BOXES AND MANHOLES

PART 1 – GENERAL

- 1.1 Furnish and install electrical underground pullboxes and manholes as specified and as shown on the electrical drawings.
- 1.2 Submit manufacturer's data for all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

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

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

PART 3 – INSTALLATION

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

END OF SECTION

SECTION 26 22 13

DRY TYPE TRANSFORMERS

PART 1 – GENERAL

- 1.1 Furnish and install where indicated on the drawings dry type transformers with voltage and phase as shown on the drawings. The transformers shall be 60 Hz with KVA rating as shown on the drawings.
- 1.2 Submit shop drawings and manufacturer's data for each transformer including:
 - 1.2.1 Incident energy level calculations
- 1.3 **Common submittal mistakes which will result in the submittal being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

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

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

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

PART 3 – EXECUTION

- 3.1 Dry type transformers larger than 112.5KVA rating shall have a minimum of twelve inches clearance between transformer ventilation openings and adjacent structure. Transformer connections shall be made with flexible conduit.
- 3.2 All lugs shall be torque tested in the presence of the inspector of record.
- 3.3 Transformers shall be anchored to the structure to resist seismic activity in accordance with Zone 4 requirements. Provide a minimum of four (4) ½-inch diameter anchor bolts for floor or roof mounted transformers.
- 3.4 Transformers mounted on roofs shall be installed on a roof curb. All conduits shall enter the transformer enclosure within the curbed area.
- 3.5 Arc Flash and Shock Hazard
- 3.5.1 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.

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

END OF SECTION

SECTION 26 24 16

PANEL BOARDS

PART 1 – GENERAL

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

PART 2 – PRODUCTS

- 2.1 The interrupting rating of circuit breakers shall be 10,000 amps for the 120/208 system and 14,000 amp for 277/480 volt systems. Refer to drawings for higher interrupting rating requirements. All components and equipment enclosures shall be manufactured by the same manufacturer. Circuit breakers shall be permitted to be series rated to limit the available fault current to no more than the above ratings.

- 2.2 All panels shall be fully bussed. Recessed panel enclosures shall be a maximum of 20" wide and 5-3/4" deep for all panels 600 amp rated and less.
- 2.3 All busses shall be tin-plated aluminum and shall be located in the rear of the panelboard cabinet. Individual circuit breakers shall be bolt on type and removable from the cabinet without disturbing the bussing in any way. All panel boards shall contain ground busses.
- 2.4 Panel covers shall be door in door style, with one lock. Door lock shall allow access to breakers only. Access to wireways without removal of cover shall be permitted by (non removable) screws behind the locked door. Panel cover shall be provided with full length piano hinge. All locks for all panels provided in this project shall be keyed alike.
- 2.5 Each panel shall have a two-column circuit index card set under glass or glass equivalent on the inside of the door. Each circuit shall be identified as to use and room or area. Areas shall be designated by room numbers. Room numbers shown on the drawings may change and contractor shall verify final room numbers with the architect prior to project completion.
- 2.6 Tandem mounted or wafer type breakers are not acceptable.
- 2.7 Multiple breakers shall have one common trip handle or be internally connected. Handle ties are not acceptable.
- 2.8 Breaker arrangements shown in the drawings shall be maintained. The circuit breakers in panels must match the orientations indicated on the drawings. In other words, if a 30 amp breaker is shown on the drawing in Space #2, this must be the location it appears on the submittal schedule. Standard factory arrangements will not be accepted.
- 2.9 Where conductor sizes exceed the standard breaker lug wire range, or where multiple conductors per phase are required, the panelboard manufacturer shall provide the breaker with suitable lugs for terminating the specified conductors.
- 2.10 Acceptable manufacturers are Square D, Eaton, Siemens or General Electric.
- 2.11 Equipment manufactured by any other manufacturers not specifically listed in Section 2.10 are not considered equal, or approved for use on this project.

Surge Protective Device (SPD)

- 2.12 Surge Protective Device (SPD) panelboards, shall be provided with an integrated circuit breaker panelboard and parallel connected suppression / filter system in a single enclosure. The SPD panelboard shall meet the following parameters: IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, UL 1283 and the UL 1449, Third Edition, effective September 29, 2009.
- 2.13 The panelboard shall be UL 67 Listed and the SPD shall be UL 1449 labeled as Type 1 or Type 2 or as Type 4 intended for Type 1 or Type 2 applications. SPD shall be factory installed integral to the panel board.

2.14 The SPD panelboard shall be top or bottom feed according to requirements. A circuit directory shall be located inside the door.

2.15 SPD shall meet or exceed the following criteria:

2.15.1 For standard areas supply SPD having 100kA per phase surge current capacity. For mountain and desert areas (areas with over 5 lightning strikes per year), SPD shall have a per phase surge current capacity of 200kA.

2.15.2 UL 1449 – Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

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

2.15.3 SPD shall be UL labeled with 100kA Short Circuit Current Rating (SCCR).

2.16 UL 1449 - Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

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

2.17 SPD shall be UL labeled with a minimum 100kVA short circuit rated (SCCR).

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

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

2.19 SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz. No filtering is required for a 100kA SPD.

2.20 Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.

2.21 Type 4 SPD shall include a serviceable, replaceable module.

2.22 SPD shall be equipped with the following diagnostics:

2.22.1 Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.

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

- 2.23 SPD shall have a response time no greater than 1/2 nanosecond
- 2.24 SPD shall have a 10 year warranty
- 2.25 The SPD panelboard shall have removable interior
- 2.26 The SPD panelboard main bus shall be aluminum and rated for the load current required
- 2.27 The SPD panelboard shall include a 200% rated neutral assembly with copper neutral bus
- 2.28 The unit shall be provided with a safety ground bus

(SPD) Quality Assurance

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

PART 3 – EXECUTION

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

Arc Flash and Shock Hazard

- 3.4 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
 - 3.4.1 **All studies shall be performed by “Emerson Electric” (858) 695-9551, MTA (858) 472-0193, or Terra Power Solutions (858) 380-8170. Studies performed by manufactures or other engineering or testing companies must submit qualifications for approval by Johnson Consulting Engineers, 7 days prior to bid for this project.**

- 3.5 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16 Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
- 3.6 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department
- 3.7 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.

END OF SECTION

SECTION 26 27 26**SWITCHES AND RECEPTACLES****PART 1 – GENERAL**

- 1.1 Furnish and install all wiring devices as shown on drawings and as herein specified. Unless otherwise noted, device and plate numbers shown are Hubbell and shall be considered the minimum standard acceptable. Other acceptable manufacturers are Pass and Seymour, Leviton, General Electric and Bryant.
- 1.2 Submit manufacturers' data on all items.
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not correctly indicating ampacity rating of proposed devices.
 - 1.3.2 Not including all items listed in the above itemized description.
 - 1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.4 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

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

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

- 2.2 All switches shall have the "on" and the "off" position indicated on the handle. If switches of higher ampere ratings are required, they shall be of similar type and quality as those shown above. Groups of switches shown at one location shall be installed under a single plate up to a maximum of six where more than six switches are shown coordinate arrangement with the Architect.
- 2.3 Dimmer switches for incandescent lamp loads shall be square-law type, slide control dimmer with OFF position, Lutron or Hubbell "Nova-T" Series NT-600 (0-

500 watt load), NT-1000 (501-900 watt load), NT-1500 (901-1500 watt load), or equal (no known equal).

- 2.4 All convenience receptacles and special outlets throughout shall be grounding type. Convenience receptacles shall be side wired, parallel slot, two pole, three wire, 20 amp as follows:

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

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

PART 3 – EXECUTION

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

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

END OF SECTION

SECTION 26 28 16

DISCONNECTS

PART 1 – GENERAL

- 1.1 Furnish and install all disconnect switches as shown on the drawings and as required by the CEC.
- 1.2 Submit manufacturers' data for all disconnects and fuses.
 - 1.2.1 Disconnects
 - 1.2.2 Fuses
- 1.3 **Common submittal mistakes which will result in the submittals being rejected:**
 - 1.3.1 Not including all items listed in the above itemized description.
 - 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
 - 1.3.3 Not including actual manufacturer's catalog information of proposed products.
 - 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

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

PART 3 – EXECUTION

- 3.1 Mount all switches to structure or U-channel support. U-channel supports shall be cleaned and painted to prevent rust.
- 3.2 Switches shall be accessible with proper clearances in front per CEC 110-16.
- 3.3 All lugs shall be torque tested in the presence of the inspector of record.
- 3.4 Arc Flash and Shock Hazard
 - 3.4.1 The contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
 - 3.4.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16. Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
 - 3.4.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
 - 3.4.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed and in no case more than 8 cal./cm².

END OF SECTION

SECTION 26 90 90

ELECTRICAL CLOSEOUT

PART 1 – GENERAL

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

PART 2 – EXECUTION

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

END OF SECTION

SECTION 27 01 00

COMMUNICATIONS GENERAL PROVISIONS

ARTICLE 1 - SUMMARY

- 1.1 This Division of the specifications outlines the provisions of the contract work to be performed as a sub contract under the Division 26 scope of work. Reference the Division 26 Electrical General Provisions for scope of work and general requirements.
- 1.2 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under Division 1 requirements.

END OF SECTION

SECTION 27 10 00

DATA/ AV INFRASTRUCTURE

PART 1 – GENERAL

- 1.1 Include all labor, equipment and materials necessary for providing a complete networking infrastructure system as described herein and/or as indicated on the drawings.
- 1.2 Related specification sections:
 - 1.2.1 Section 26 01 00 – General Provisions
 - 1.2.2 Section 26 05 19 – Conductors
 - 1.2.3 Section 26 05 33 – Conduit and Fittings
 - 1.2.4 Section 26 05 34 – Outlet and Junction Boxes
- 1.3 Approved minimum Product and Contractor Extended Warranty Certifications;
 - 1.3.1 All components shall be manufactured by one of approved manufacturers, the installing Contractor must have the accompanying certification from the product manufacturer(s) for installation of an “Extended Warranted System” as required by each manufacturer and as indicated in these specifications.
 - 1.3.1.1 Specified system warranties are to be established between the component and cable manufacturers and the District, warranties between the cable manufacturer only or installing Contractor and the District are not considered equal.
 - 1.3.1.2 Warranty shall be a full “Performance Warranty” installed by a “Certified Contractor” as specified by one of the approved manufacturers. A “Component Warranty” will not be considered equal. All components, labor, and “Performance Criteria” shall be warranted by one of the approved manufacturers.
- 1.4 Acceptable manufacturers are:
 - 1.4.1 **LEVITON / BERK-TEK**
 - 1.4.1.1 Installing Contractor must be LEVITON Network Solutions Premier certified to install this system.
 - 1.4.1.2 Warranty provision and training must be for the Leviton/Berk-Tek – Limited Lifetime Premium Performance Warranty program.
 - 1.4.2 **COMMSCOPE**

- 1.4.2.1 Commscope's Training and Warranty programs encompass the brand names known as Systimax and Uniprise.
- 1.4.2.2 Installing Contractor must be PartnerPro certified to install any of the systems under the Commscope Family of brand names. Alternate certification that apply as well is Systimax Premier Certification for products installed with the Systimax brand name.
- 1.4.2.3 Warranty provision and training must be for the Commscope (Uniprise and Systimax) – 25-Year Premium Performance Warranty program.
- 1.4.3 **ORTRONICS (Legrand) /Superior Essex**
 - 1.4.3.1 Installing Contractor must be CIP-ESP or IP certified to install this system.
 - 1.4.3.2 Warranty provision and training must be for the nCompass – Lifetime Premium Performance program.
- 1.4.4 **Panduit/General Cable**
 - 1.4.4.1 Installing Contractor must be PanGen certified to install this system.
 - 1.4.4.2 Warranty provision and training must be for the PanGen Certification Plus – 25-Year Siemon Premium Performance program.
- 1.4.5 **Siemon**
 - 1.4.5.1 Installing Contractor must be Siemon Certified Installers (CI) certified to install this system.
 - 1.4.5.2 Warranty provision and training must be for the Premium 6 Certification – 20-Year Premium Performance program.
- 1.4.6 Warranty shall be to the District, for the period as defined by the Network Infrastructure System selected for installation, after District acceptance and sign-off of the completed system. The Contractor must provide documentation from one of the approved manufacturers, as indicated in Section 1.3, indicating their qualifications for installation of this system in compliance with the manufacturer/s warranty period requirements as warranted Contractor.
- 1.4.7 Equipment qualifications: It is the intent of these specifications that each bidder provides all hardware, components and installation services that are necessary to ensure a fully operational wiring system including warranties, as shown in the EIA/TIA Category-6 guidelines.

- 1.4.8 All components, parts, infrastructure, patch cables, termination panels and cables must be classified by the manufacturer or manufacturers as a part of the "Extended Warranty" program. Contractor may not mix in components from other certified programs or materials that are not considered part of the "Lifetime" warranty.
- 1.4.9 Systems or components as manufactured by any other manufacturer which, are not specifically listed in 1.3 are **not** approved for use on this project.
- 1.5 **Installing Contractor qualifications:** Firms and their personnel must be regularly engaged in the installation of data networking cabling and equipment for systems of similar type and scope. The Contractor must have a full-service office able to respond to emergency callouts during the warranty period. The Contractor must also provide complete installation of all wiring and devices or equipment. **Subcontractors with Electrical Contractors or other warranted or non-warranted Contractors for supervised installation of any part of this system are not approved.**
 - 1.5.1 Contractor shall have on staff a minimum of (1) BICSI RCDD as full-time employees.
 - 1.5.2 The successful Contractor shall be a California licensed C7 or C10 Premise Wiring Contractor as defined in this specification.
 - 1.5.3 All work shall be performed under the supervision of a company accredited and trained by the Manufacturer of the components and cable and such accreditation must be presented with the bid submittal. All personnel performing work on this project must have successfully completed the manufacturer's training courses to completely comply with the extended warranty requirements prior to performance of any work on this project. Accreditation will consist of individual employee certifications issued by the manufacturer or manufacturers.
 - 1.5.4 All personnel engaged in the testing of premises fiber optic and copper UTP cable systems must have successfully completed the test equipment manufacturer's training courses. Certification of such training must be presented with the bid submittal. Cut sheets of the test equipment to be utilized shall be provided with Phase I project material submittals.
 - 1.5.5 This project shall employ Category-6 cabling. The Contractor shall install the related components in relation to the performance requirements for the type of cable installed.
 - 1.5.6 If Contractor routes cable and/or associated pathways in another route than indicated on the drawings, they shall maintain all maximum cable installation distances as required by the manufacturer's distance limitations.

- 1.6 In order to ensure project cohesion, a single point of contact is required to provide a "TURNKEY" solution. The work covered under this section of the specification consists of furnishing all: labor, cabling, equipment, supplies, materials, and training.
- 1.7 The drawings indicate a schematic routing of cables above-ceiling cable prior to bid. Where cables penetrate through walls a conduit sleeve shall be provided. Where cables pass through fire rated walls, the conduit sleeve shall be sealed to maintain the rating of wall assembly.
- 1.8 Unless otherwise noted in the project drawings or these specifications, the Division 26 Contractor shall provide the installation of all conduits, outlet and junction boxes, trenching and pull box installation.
- 1.9 General Submittal Requirements
 - 1.9.1 **Group #1 Submittal** shall be made in electronic format within (20) working days after the award of the contract by the District. This submittal shall include the following:
 - 1.9.1.1 Complete Bill of Materials in Excel Spreadsheet format with bills of quantities, including all materials, components, devices, and equipment required for the work. The bills of quantities shall be tabulated respective of each and every system as specified, and shall contain the following information for each Section listed - Description and quantity of each product, Manufacturer's Name and Model Number, Manufacturer's Specification Sheet or Cut Sheet and Specification Item Number referenced for each required product or if not shown in the specifications, Drawing Detail Number being referenced. (ie; Spec. 27 20 00 Item 2.1.3 and/or Detail #1/E4.15).
 - 1.9.1.2 Material Cut Sheets shall provide detailed product information and shall be original manufacturer product bulletins.
 - 1.9.1.3 Copies of material information from vendor websites shall not be considered equal and will not be accepted. Copies of Web pages which include multiple pages of irrelevant information not associated with the product cut sheet shall not be considered equal and will not be accepted.
 - 1.9.1.4 Material Cut Sheet part number provided shall be highlighted or provided with an arrow directed at the corresponding part number.
 - 1.9.1.5 Equipment items which have individual components will require that all component parts be listed individually.
 - 1.9.1.6 Description of any specialty backbox requirements

- 1.9.1.7 All wiring types required for installation of this system
- 1.9.1.8 Spare parts shall be listed individually to verify proposed quantity
- 1.9.1.9 Include with submittals all warranty information and a description of support and maintenance services to be provided. Also include all licenses and maintenance agreements required for continued operation of the equipment.
- 1.9.2 **Group # 2 Submittal** shall be provided within (20) working days after the approval of the Group # 1 submittals and prior to any fabrication or field conduit installations. All shop drawings shall be engineered and drawn on a CAD System. Each submission shall include 'D' or 'E' size print copies to match the contract drawings, and (1) USB Flash Drive copy with files in a AutoCAD format. Building floor plan CAD files will be made available. Contractor shall make the request for drawings in writing directly to Johnson Consulting Engineers, confirmation of the request and a release form will be forwarded to the contractor to include a signed copy prior to release of files. Detail or riser diagram sheets or any other drawings other than floor or site plans, will not be made available to the contractor. Phase II Submittals drawings shall include the following:
 - 1.9.2.1 MDF and IDF equipment rack or cabinet elevations will be required to be provided including cable routing, grounding, support, UPS, network electronics, etc. and position of all components in the rack or cabinet.
 - 1.9.2.2 Provide labeling plan which identifies the proposed scheme for identifying all components including racks, patch panels (fiber and copper), site distribution feed cables, horizontal station cables and site conduit systems (handholes, pullboxes, etc.).
 - 1.9.2.3 Provide shop drawings showing all end device locations, tap values, paging zones and amplifier sizing for each zone for analog speakers and horns, including devices connected to IP-Based zone controllers.
- 1.9.3 Common submittal mistakes which will result in submittals being rejected:
 - 1.9.3.1 Not including the qualifications of the installing Contractor Company and Contractor's Staff.
 - 1.9.3.2 Not including all items listed in the above itemized description.
 - 1.9.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlights, underlining or clouding the items to be reviewed (provided for the project) or crossing out the items which are not applicable.

- 1.9.3.4 Not including actual manufacturer's cut sheets or catalog information of proposed products.
- 1.9.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.
- 1.9.4 The Contractor shall make a written request directly to Johnson Consulting Engineers for electronic drawing files (CAD). As a part of the written request, please include the following information:
 - 1.9.4.1 Clearly indicate Project Name and Client, Johnson Consulting Job Number (located in the bottom left corner of JCE Engineering Stamp) and each drawing Sheet Number required (i.e. E1.1, E2.1, E4.1 etc.)
 - 1.9.4.2 Identify the Name, Company, Title, phone number, mailing address and e-mail address of the person to receive the files.
 - 1.9.4.3 Detail or Riser diagram sheet, System Schematic drawings or any other drawings other than floor plans or site plans, will not be made available to the Contractor.
 - 1.9.4.4 Files will only be provided in the AutoCAD format in which they were created (i.e. version 2015 or version 2016). Files will not be made available in REVIT format.
 - 1.9.4.5 Requests for files will be processed as soon as possible; a minimum of (7) working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use and delays in requesting files will not alleviate the Contractor from submitting required documents within the required timeline.

PART 2 – PRODUCTS

- 2.1 Equipment racks to be furnished by Others.

Sound System Indoor/Outdoor Fiber Optic Feed Cable

- 2.2 Provide installation and termination of Fiber Optic Feed Cables from the Permanent Sound System Cabinet to the Soccer Control Station Pedestals in the playing field. Fiber optic termination shall be provided on standard wallplates at the pedestal location and at the Ethernet Converter location inside the Sound Cabinet at the other end. Contractor shall furnish and install all fiber optic cables and cable termination.
 - 2.2.1 Contractor shall provide a minimum of 10-feet of slack on the fiber feed cable stored inside the Sound System Cabinet as a Service Loop. Neatly

dress and store the Service Loop on the inside wall of the cabinet. Provide Velcro tie managers attached to the inside wall. Fiber optic cables shall have a minimum of 12" of stripped slack at the Sound System Cabinet end and a minimum of 6" of slack at the wallplate location stored inside the junction box.

- 2.3 Provide one continuous fiber optic cable routed from the Sound System Cabinet to each Soccer Control Station Pedestal as shown on the drawings.
- 2.4 Outdoor Fiber Feed Cable Applications – Fiber optic cable shall be rated for outdoor/riser rated applications. Construction shall consist of, all dielectric, tight buffer with central strength member, flame retardant PVC or PE jacket, rated OFNR, dry water-blocking compound only, and blank fillers are required. Central tube type fiber will not be considered equal.
- 2.5 Fiber optic feed cables for the infrastructure must be installed as follows:
 - 2.5.1 Provide a total of 6-strands of Multimode OM4-Rated fiber optic glass as shown on the drawings to each Soccer Control Station Pedestal location.
 - 2.5.2 Feed cables shall be clearly defined and labeled for each system.
 - 2.5.3 Terminate fiber cables with Duplex LC-Type connectors.
- 2.6 Cable shall contain one or all types of fibers listed below:
 - 2.6.1 Provide Multimode 50/125-micron fiber optic glass, (minimum OM4 laser-optimized grade) for dual mode operation at 850 nm and 1300 nm wave lengths.
 - 2.6.2 Maximum attenuation at 3.0dB/km @ 850nm and 1.0dB/km @ 1310nm. Minimum 1-gigabit Ethernet distance guarantee of 1110 meters @ 850nm and 600 meters @ 1300nm. Minimum 10-gigabit Ethernet distance guarantee of 550 meters @ 850nm/1300nm. Fiber shall be ISO-TIA OM4 plus rated.
 - 2.6.3 Refer to drawings for cable types required. Refer to acceptable cables section for additional information and approved manufacturers.
- 2.7 Each fiber optic cable shall contain the quantity of strands of optical fibers as detailed on the drawings.
- 2.8 All fibers in a multi-fiber cable shall be fully operational within the required performance characteristics. If any individual fiber does not meet the minimum standards, the entire cable must be replaced, end to end, including connectors, without any additional expense to the customer.
- 2.9 Acceptable cables shall be:

- 2.9.1 Berk-Tek Multimode – GIGALITE 10-XB-OM4+
- 2.9.2 Commscope Multimode 550 OM4 – (All Brands) Systimax LazrSpeed
- 2.9.3 Superior Essex Multimode – TeraFlex 10G-550-OM4+ (Type P)
- 2.9.4 General Cable Multimode – Clear Curve OM4+ (Type BM)
- 2.9.5 Siemon Multimode – XGLO 550 OM4 (Type T501)
- 2.10 Above glass types are an example of product names per manufacturer. Confirm requirements for indoor/outdoor, riser and plenum rated cable with riser drawings and site plans. Part numbers for composite style cable will vary greatly. Confirm part numbers with manufacturer.
- 2.11 Fiber optic feed cables shall be terminated with Duplex LC-Type connectors at the Sound System Cabinet location. There will be no patch panel provided. Fiber cables shall directly connect to the Ethernet Media Convertor inside the Sound Cabinet. Ethernet Media Convertor provided by Others. Scoreboard Contractor will connect fiber cables to the media convertors.
- 2.12 Provide fiber optic cable termination at each Soccer Control Station Pedestal. Fiber optic feed cables shall be terminated with Duplex LC-Type connectors at the Soccer Control Station Pedestal location. Fiber cables shall be terminated on a Duplex Decora wallplate using Decora inserts. Provide (3) Leviton Quick-Port Aqua Colored Duplex LC inserts for connection to wallplate Model #41086-LLW (or equal by the approved manufacturers). Wallplate shall be provided with (2) Dual Port Decora inserts as manufactured by Leviton Model #41642-W (or equal by the approved manufacturers) and (1) Duplex Wallplate Leviton #80409-W(or equal by the approved manufacturers). Scoreboard Contractor will connect fiber cables to Portable Systems.

Sound System OSP Category-6 UTP Cable

- 2.13 Contractor shall provide a total of (2) Sets of (2) OSP-Rated Category-6 UTP cables from the Sound System Cabinet to the Scoreboard as shown in the drawings.
- 2.14 The cable shall be UL or ETL rated and UL verified in compliance Category-6 EIA/TIA standards. Approved cables for Network Infrastructure System:
 - 2.14.1 Where data cables are indicated to run underground, Contractor shall use a Category-6 OSP-rated cable. Approved cables for Network Infrastructure System: Commscope #CS34O OSP-Rated with black PE jacket (or Cat-6 OSP-Rated versions by the Approved Manufacturers)
- 2.15 Manufacturer names and part numbers are shown as a point of reference and do not specifically designate required packaging or color for the cable. Contractor

shall verify colors and packaging options shall be determined by Contractor preferences.

- 2.16 Unshielded twisted pair Category-6 outlets shall be an RJ45 Enhanced performance type 8-position / 8-conductor modular jacks, and shall comply with Category-6 performance requirements. Provide single port, dual port, four port or quantity as indicated on the floor plans at each outlet location. All outlets shall be wired in an EIA/TIA 568B configuration.
- 2.17 Provide Category-6 insert installation kits for all locations furnished with Category-6 UTP cabling. Confirm with Scoreboard Installation Contractor the exact location at the Scoreboard where the cables are to be terminated. Terminate cables inside the Sound System Cabinet at the Ethernet Media Converter. Contractor shall confirm all final locations prior to terminating the cables.
- 2.18 Contractor shall be responsible for confirming all color requirements prior to ordering or installing.
- 2.19 Provide the following Category-6 UTP data connector per Network infrastructure warranty requirements:
 - 2.19.1 Leviton eXtreme Cat6+ Quick Port Series 61110-R
 - 2.19.2 Systimax (Commscope) GigaSpeed XL Series MGS400
 - 2.19.3 Uniprise (Commscope) UNJ 600 Series UNJ600
 - 2.19.4 Ortronics Clarity 6 Tracjack Series OR-TJ600
 - 2.19.5 Panduit MiniCom TX6 Plus Series CJ688TG
 - 2.19.6 Siemon MAX-6 Series MX6-F

Sound System Audio Cables

- 2.20 Provide installation and termination of XLR Microphone Cables from the Permanent Sound System Cabinet to the Soccer Control Station Pedestals in the playing field. XLR termination shall be provided with ruggedized Male XLR connectors at both ends. Contractor shall furnish and install all cables and cable termination.
- 2.21 Provide (1) OSP-Rated Microphone cable from the Sound System Cabinet to each Soccer Control Station Pedestal as shown on the drawings. Cable shall be sized as required to compensate for voltage drop loss. Provide cable as manufactured by Belden, Canare or West Penn. Confirm operation with Scoreboard Contractor prior to ordering cable.
- 2.22 Terminate XLR Microphone cable with ruggedized Male XLR Connector for wet locations. Provide Neutrik Model NC3MX-HD Male Water Resistant Heavy Duty

XLR connector at each end of the cable. Confirm final location of the cable termination points with the Scoreboard Contractor.

- 2.23 Provide (3) 10AWG OSP-Rated Speaker cables cable from the Sound System Cabinet to the Scoreboard location as shown on the drawings. Provide wet location cable as manufactured by Belden or West Penn. Speaker cables shall be terminated on equipment provided by the Scoreboard Contractor. Terminate cables at locations as indicated by the Scoreboard Contractor at the Sound System Cabinet and Scoreboard location. Confirm operation with Scoreboard Contractor prior to ordering cable.

PART 3 – INSTALLATION

- 3.1 Pull strings shall be provided with all cable runs. Pull strings shall not be substituted for pull ropes for the exterior site conduits.
- 3.2 Velcro cable management straps are required on all cable bundles, the last 10 feet or upon entry into equipment, a maximum of 12" apart. Cable bundles shall also be routed through cable management holders in the equipment locations.
- 3.3 Labeling
 - 3.3.1 Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each outlet and termination point. A printed label shall be placed at each of the following locations:
 - 3.3.1.1 On each cable in the j-box behind the faceplate location. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTALE EQUAL).
 - 3.3.1.2 On the cable at the terminal strip prior to termination point. Requires the use of a self-laminating wrap around label. Brady Label self-laminating 1.2" by 1.5" wrap around label Part #29689 (NO ACCEPTALE EQUAL).
 - 3.3.1.3 On the face of the faceplate in the label holder window. The label shall be clearly defined with a minimum #10 font size.
 - 3.3.2 Handwritten labels are not permitted. Where cable ID includes room number identification, the Contractor shall obtain written verification of final room numbers prior to beginning labeling (numbers on plans do not always match final room numbers). Cable pulling cross reference lists will not be accepted with final documentation.
 - 3.3.3 All faceplates shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for replacing defective labeling for a period of one year from date of final sign-off of project.

- 3.3.4 All fiber optic and UTP feed cables shall be identified with permanent, water resistant, printed labels. Labeling information shall include closet identifications, quantity of conductors (UTP) or strands (fiber) and house pair designations (UTP). Cables shall be labeled in the equipment locations at the site conduit entrance point. Labels for fiber and copper feeds shall include both the name of the origination point and the destination point, house pair or house fiber strand count, cable composition (i.e., 12-Strand MM 50/125 LO; 6-Strand SM). See details for additional requirements.
- 3.3.5 Labeling will follow recommended EIA/TIA standards or as requested by the customer. Contractor will confirm labeling pattern prior to final identification or testing. All test results will be identified by the final labeling scheme. Contractor shall be required to have the labeling scheme approved in writing by the District IT Director prior to manufacture or installation of the labeling.
- 3.3.6 All fiber optic cables and/or innerduct shall be tagged with fiber optic warning tags in every manhole or pullbox. Fiber warning tags shall also be placed at each end of the cable in the termination closets in clear view. A minimum of (3) tags are required at each end, with a label tag on each cable in the service loop. Fiber warning tags shall be placed on fiber optic cable and/or innerduct routed through open ceiling environments at increments no less than 15 feet apart.
- 3.3.7 Refer to detail drawings for additional labeling requirements.
- 3.4 Provide 6 inches of cable slack at computer data system outlets inside conduit box.
- 3.5 Do not provide a service loop in the MDF/IDF Room on the UTP cables, unless otherwise noted. Cables shall be neatly routed around the perimeter of the room to the cable runway from the point of entrance into the room.
- 3.6 The minimum bending radius for all cables and the maximum pulling tension shall not exceed manufacturer's recommendations.
- 3.7 Cables installed in manholes and pullboxes shall be supported with Velcro ties or loosely fitted UV rated tie wraps, on wall mounted cable support racks. The cables shall be clearly labeled in the manhole or pullbox.
- 3.8 Provide a full 360-degree loop of slack cable around manhole and pullbox interiors. Cables entering handholes from the bottom, shall not be allowed to touch the bottom of the cover when closed and shall not be pinched or crushed in any way.
- 3.9 Cable pulling shall use a split mesh grip over the cable jacket. Connection directly to optical fibers and copper wire conductors shall not occur.

- 3.10 When pulled through conduits, cable pulling lubricants shall be continuously applied to all cables and be specifically approved by the manufacturer.
- 3.11 Where cables are pulled through or pulled from a center run, pull without splices or terminations, lead out the cables at all manholes, pullboxes, and conduits, taking care to feed them in again by hand for the next run.
- 3.12 For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multi-segmented sheaves, etc., shall be used to ensure proper cable pulling tension and side wall pressures. Cables shall not be pulled directly around a short right-angle bend. Any device or surface the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable bending radius. The maximum possible size radius sheaves and feed-in tubes, usable in the available working space shall be provided in all situations, to ensure the minimum possible cable sidewall pulling pressure. Do not use devices with multi-segment "roller" type sheaves.
- 3.13 Cable lengths over 250 feet shall be machine pulled, not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum pulling speed shall be greater than 15 feet per minute.
- 3.14 A pull string shall be placed with all UTP and paging station cables at the time of installation. Conduit runs and surface raceway for station cabling shall be furnished with a minimum 2-Ply spiral wrap style, pull string rated for 240 ft/lbs. pulling strength, such as manufactured by Greelee #431 or approved equal. Includes all conduit stubs and cables routed through open ceiling and cable trays. Pull strings shall be tied off in the junction box and in the ceiling. Provision for the installation of the pulls string shall apply to all empty and spare conduits as well. Single ply type pull string will not be accepted as a substitute for the 2-ply pull string.
- 3.15 A measuring pull tape shall be placed with all feed cables at the time of installation. Indoor riser and outdoor conduit runs between buildings designated for feed cabling, in excess of 150 feet shall be provided with a minimum 1/2" polyaramid style, measuring true tape pull string annotated with footage increments rated for 2500 ft/lbs. pulling strength, such as manufactured by Greenlee #39245 or approved equal. Conduit runs less than 150 feet shall be furnished with a 1/4" polyaramid style, measuring true tape pull string annotated with footage increments rated for 1250 ft/lbs. pulling strength, such as manufactured by Greenlee #39243 or approved equal. Provision for the installation of the measuring pull tape shall apply to all empty and spare conduits as well. Standard twine style pull strings and standard nylon or polypropylene style pull ropes will not be accepted as a substitute for the polyaramid measuring tape pull string.
- 3.16 When pulling cable through conduit, cables shall be pulled straight into or out of the raceway without bends at the raceway entrance or exit. Pull in cable from the end having the sharpest bend (i.e., bend shall be closest to the reel). Keep

pulling tension to minimum by liberal use of lubricant, hand turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one at manhole or pullbox during this operation. Cables shall be pulled directly from cable reels.

- 3.17 Where cables are not installed in a conduit or other raceway system, they shall not be routed parallel with other line voltage equipment or wiring (120 volt and above) with 36" or within 12" of line voltage equipment or wiring where crossing.

TESTING

- 3.18 All Category-6 cables shall be point to point (link) tested after installation/termination and verified to operate at minimum 1000Mbps. Performance of installed cables shall satisfy all current addendums to the EIA/TIA 568A standard for Category-6 wiring. In addition, testing shall satisfy all proposed amendments to the existing ISO/IEC requirements. The wiring shall support all specified communication protocols. Testing shall support the Category-6 requirements by the EIA/TIA.
- 3.19 Upon completion of testing cable links for both copper and fiber optic cabling, the Contractor shall supply a copy of the original database files downloaded from the tester in original format on a USB Flash Drive. Contractor shall provide with the testing database files, an original copy of the tester's manufacturer software program (included in original cost) for record management and archiving, in a Windows format (i.e., Fluke Linkware software program).
- 3.19.1 The manufacturer's software program will be used by the Project Engineer to review all test results, and then turned over to the District to keep as their record copy with the final approved test results. Provide (3) copies of tests on USB Flash Drives. Do not submit test results for review in Excel or PDF file formats, as the submittal will be rejected and not reviewed.
- 3.20 Contractor will repair or replace cable runs or connecting hardware that do not meet specified criteria.
- 3.21 Multimode fiber optic cables shall be tested bi-directionally at 850nm and 1300nm. All fiber strands shall be tested with an OTDR (Optical Time Domain Reflectometer). All fiber test results shall contain final source and destination information that matches IDF or MDF labeling shown on the fiber optic patch panels and final documentation. OTDR tests results shall be included with the copper test results and submitted with the tester's software for review. Do not submit test results for review in Excel or PDF file formats, as the submittal will be rejected and not reviewed.
- 3.22 Test procedures shall comply with EIA/TIA 526-14 Method B. Test results shall meet the minimum following criteria:

- 3.22.1 Fiber optic test results shall not exceed 2db total attenuation loss in addition to inherent loss published by manufacturer tested at minimum 2000 Mhx for 805nm and 500 Mhz for 1300nm for the fiber optic cable.
- 3.23 End to end attenuation Fiber Optic feed cabling testing shall be performed with a temporary test jumper cable at each end of the installed fiber cable. The test jumper utilized shall be the same fiber core size and grade of glass as the installed cable. The measured attenuation of the test jumpers, test connectors, and test interconnection sleeve between the two test jumpers shall be less than 1dB as calibrated at the time of the test at indicated wave lengths and frequencies. Test jumpers shall be “zeroed out” before testing of fiber stands begins.
- 3.24 Final As-Built Drawing Submittals – Provide (1) hard bound copy of “E-size” As-Built drawings and (3) copies on USB Flash Drive in AutoCad (2014 or newer version) format. A Hand marked-up copy of the original construction drawings will not be accepted as the final As-Built drawing submittal. Final As-Built drawings shall include copies of the floor plan drawings of each building, detailed elevations of each MDF or IDF locating all equipment, quantities outlets and speaker locations, locations of all sleeves and identification of all final cable routes. In addition, the drawings shall include all outlet locations with cable identification numbers.

END OF SECTION

SECTION 31 11 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees to remain.
2. Removing existing trees, shrubs, groundcovers, plants, grass, A.C. paving concrete curb, gutter and base material, and existing concrete slabs.
3. Clearing and grubbing, removal of existing brush and trees, unless shown to remain.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion and sedimentation control measures.

B. The contractor attention is directed to the requirements in Division 1 regarding the preservation of existing trees. The work also includes the removal and disposal of obstacles above and below ground that conflict with the work in this project whether or not such obstructions are as shown on the plans.

C. Related Sections include the following:

1. Division 1 for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and temporary erosion and sedimentation control procedures.
2. Division 1 Section "Field Engineering" for verifying utility locations and for recording field measurements.
3. Division 2 Section "Building Demolition" for demolition of buildings, structures, and site improvements.
4. Division 2 Section "Tree Protection and Trimming" for protecting trees remaining on-site that are affected by site operations.
5. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.2 REFERENCED STANDARDS:

A. The editions, specifications and standards referenced herein, published by the following organizations apply to the construction only to the extent specified by the reference.

B. Standard Specifications:

1. Standard Specifications for Public Works Construction (current edition).

2. Standard Special Provisions of the Regional Standards Committee.
3. City of San Diego Standard Special Provisions, Document No. 769345 (current edition).
4. California Department of Transportation, "Manual of Traffic Controls, for Construction and maintenance Work Zones", (current edition), Document No. 869159.

C. Standard Drawings:

1. City of San Diego Standard Drawings, Document No. 769374 (current edition).

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Campus's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Division 1 Section "Project Closeout," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Quality Control."

1.7 PROJECT CONDITIONS

- A. The plans show general information only. It shall be the responsibility of the Contractor to examine the site to determine the exact existing conditions and character and extent of the work to be performed and clearing operations required.
- B. Existing underground lines shown on the plans are shown from best possible information available and shall be verified prior to start of any work. The Contractor is responsible for locating all underground lines by potholing and/or locator service. The Campus maintains a list of locator firms familiar with the underground conditions.
- C. Preserve in operating condition all active utilities transversing or within and about the site. Promptly repair any damage to such utility or work due to work under this contract, to the satisfaction of the Campus's Representative.
- D. Existing appurtenances and improvements, which are to remain, shall be protected from damage due to work under this section. Such damaged facilities shall be promptly repaired and/or replaced in kind.
- E. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Campus and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- F. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Campus's property will be obtained by Campus before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Campus's Representative.
- G. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Campus's premises where indicated.
- H. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

1.8 BARRICADES AND WORK AREA:

- A. Provide barricades and warnings (signs and lighting), and maintenance and supervision thereof, in accordance with applicable Federal and State codes and their respective requirements, or as may be directed from time to time by the Campus Representative. Do not commence site clearing until barricades and warnings are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Clear and grub per Section 0300-1 standard specifications except as modified herein.

3.2 LIMITS:

- A. The limits of clearing, grubbing and demolition shall include all areas of work.

3.3 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Campus.

3.4 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.5 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Campus's Representative.
 - 1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
 - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Campus's Representative.

3.6 UTILITIES

- A. Existing utility lines shall be removed as indicated on plans. Prior to their removal, all required new re-routing and new connections shall be completed and made operative so that their functions to other existing structures served by them can be continuous and uninterrupted. Abandoned utility lines encountered during construction shall be removed.
- B. Campus will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- C. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Campus will arrange to shut off indicated utilities when requested by Contractor.

- D. Existing Utilities: Do not interrupt utilities serving facilities occupied by Campus or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Campus's Representative not less than two weeks in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Campus's Representative written permission.
- E. Excavate for and remove underground utilities indicated to be removed.
- F. Removal of underground utilities is included in Division 2 Sections covering site utilities.

3.7 USE OF EXPLOSIVES:

- A. Use of explosives will not be permitted.

3.8 CLEARING AND GRUBBING

- A. The limits of clearing and grubbing shall be the area of new construction
- B. Remove all trash, rubbish and all other material not suitable for construction operations.
 - 1. Remove trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 2. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 3. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 4. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 5. Use only hand methods for grubbing within tree protection zone.
 - 6. Chip removed tree branches and [stockpile in areas approved by [Campus's Representative] [dispose of off-site].
- C. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches , and compact each layer to a density equal to adjacent original ground.

3.9 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Limit height of topsoil stockpiles to 72 inches.
 2. Do not stockpile topsoil within tree protection zones.
 3. Dispose of excess topsoil as specified for waste material disposal.
 4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.10 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.11 DISPOSAL

- A. All removed and demolished material, including but not limited to concrete, asphalt concrete, trees, brush, vegetation and trash resulting from the work of this section is the property of the Contractor and shall be promptly removed to a legal disposal area off campus. Asphalt and concrete shall not be used as fill material unless otherwise noted.
 1. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 11 00

SECTION 31 20 00

EARTHMOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks, pavements.
5. Subbase and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling for utility trenches.
8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 1 Section 01 20 00 "Price and Payment Procedures" for quantity allowance provisions related to unit-price rock excavation and authorized additional excavation.
2. Division 1 Section 01 20 00 "Price and Payment Procedures" for unit-price rock excavation and authorized additional excavation provisions.
3. Division 1 Section 01 70 00 "Execution Requirements" for recording preexcavation and earthwork progress.
4. Division 1 Section 01 50 00 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
5. Division 1 Section 01 56 39 "Tree Removals, Protection and Repair" for protecting and trimming trees to remain.
6. Division 31 Section 31 13 00 "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
7. Division 33 Section 33 46 00 "Subdrainage" for drainage of walls and landscaped areas.

1.2 UNIT PRICES

A. Unit prices for earthwork are included in Division 1 01 20 00 Section "Unit Prices."

B. Quantity allowances for earthwork are included in Division 1 Section 01 20 00 "Allowances."

1.3 REFERENCED STANDARDS:

- A. The editions, specifications and standards referenced herein, published by the following organizations apply to the construction only to the extent specified by the reference.
- B. Standard Specifications:
 - 1. Standard Specifications for Public Works Construction (current edition).
 - 2. Standard Special Provisions of the Regional Standards Committee.
 - 3. City of San Diego Standard Special Provisions, Document No. 769345 (current edition).
 - 4. California Department of Transportation, "Manual of Traffic Controls, for Construction and Maintenance Work Zones", (current edition), Document No. 869159.
- C. Standard Drawings:
 - 1. City of San Diego Standard Drawings, Document No. 769374 (current edition).
- D. The publications listed below form a part of this specification to the extent referenced. The publications are referred to the text by basis designation only.
 - 1. American Society for Testing and Materials (ASTM) Publications:
 - 2. C 33-86 Concrete Aggregates
 - 3. C 136-84a Sieve Analysis of Fine and Coarse Aggregates
 - 4. D 4318-84 Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 5. D 1140-54 Amount of Material in Soils Finer than the (R 1971)No. 200 (75 micrometer) Sieve
 - 6. D 1556-82 Density of Soil Place by Sand Cone Method (R 1974)
 - 7. D 1557-78 Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 kg) Rammer and 18-in. (457mm) drop
 - 8. D 2103-81 Polyethylene Film and Sheeting
 - 9. D 2419-74 Sand Equivalent Value of Soils and Fine Aggregates (R 1979)
 - 10. D 2487-85 Classification of Soils for Engineering Purposes
 - 11. D 6938 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- E. D 3017-78Moisture Content of Soil and Soil-Aggregate in place by Methods (Shallow Depth)

1.4 DELIVERY AND STORAGE:

- A. Deliver and store materials in a manner to prevent contamination or segregation.

1.5 RECORDS OF INVESTIGATION:

- A. Refer to "Information Available to Bidders".

1.6 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
 - 3. Fill soils used for retaining wall backfill or placed within 1-foot below finished concrete hardscape shall not possess and $EI > 50$, per geotechnical report.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Campus's Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Campus's Representative. Unauthorized excavation, as well as remedial work directed by Campus's Representative, shall be without additional compensation.
- G. Pipe Zone: The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level 12 inches above the top of the pipe. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipes to a horizontal level above the top of the highest or topmost pipe. Thickness of pipe zone above the highest top of pipe shall be as described above unless otherwise shown on the Drawings or otherwise described in the specifications for the particular type of pipe installed.
- H. Pipe Bedding: The pipe bedding shall be defined as a layer of material below the bottom of the pipe or conduit as shown on the Drawings and extending over the full trench width in which the pipe is bedded. Use a minimum thickness of 6 inches for the pipe bedding unless otherwise shown on the Drawings or otherwise described in the specifications for the particular type of pipe installed.
- I. Fill: Soil materials used to raise existing grades.

- J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- K. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- M. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- N. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.7 SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of plastic warning tape.
 - 2. Geotextile.
 - 3. Controlled low-strength material, including design mixture.
 - 4. Geofoam.
- B. Samples: 12-by-12-inch Sample of subdrainage geotextile.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.

2. Laboratory compaction curve according to ASTM D 698/ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.
- D. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.8 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Quality Control."

1.9 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Campus or others unless permitted in writing by Campus's Representative and then only after arranging to provide temporary utility services according to requirements indicated.
 1. Notify Campus's Representative not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Campus's Representative's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Materials for compact fill shall consist of any soil imported or excavated from the cut areas. The soil shall contain no rocks or hard lumps greater than 3 inches in maximum dimension and shall contain at least 40% of material smaller than 1/2 inch in size, no more than 30% of material shall be larger than 3/4 inch. Material of perishable, spongy, or otherwise improper nature shall not be used in fills. Asphalt concrete pieces shall not be used in fill. Import fill soil shall have no more than 35% fines passing the 200 sieve, and an expansion index of less than 20 based on ASTM D4829.
- B. Native earth backfill used above the pipe zone shall be excavated, non-expansive, fine-grained material free of roots, debris, and rocks larger than 3 inches.

- C. Materials placed within 36 inches of rough grade shall be select material as specified in Part 1 above. The material shall not exceed an Expansion Index (EI) of 20 per ASTM D4829.
- D. Representative samples of material to be used for fill shall be tested in the laboratory in the order to determine the maximum density, optimum moisture content and classification of the soil.
- E. During the grading operations, soil types other than those analyzed in the report of the soil investigation may be encountered. The Campus's Geotechnical Engineer shall be consulted to determine the suitability of these soils.
- F. Fill material to be used under the building, slabs, pavement, and structures shall be on-site or imported material, conforming to the above. Excavated on-site material will be considered suitable for structural fill if it is free from organic matter and other deleterious substances and conforms to the requirements specified above. No material shall be placed without the approval of the Campus's Representative under the direction of the Campus's Geotechnical Engineer.
- G. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- H. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- I. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- J. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
 - 1. Base Course: Aggregates for base course shall conform to Section 26 of the Standard Specifications, Class 2 for 3/4 inch maximum size gradation.
- K. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- L. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

- M. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- N. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- O. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- P. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 IMPORTED SAND - PIPE ZONE:

- A. Imported sand used in the pipe zone or for the pipe base shall have the following gradation:

1. Sieve Size Percent Passing By Weight

1)	3/8 inch	100
2)	No. 4	75 - 100
3)	No. 30	12 - 50
4)	No. 100	5 - 20
5)	No. 200	0 - 10

2.3 CRUSHED ROCK:

- A. Use a 3/4 inch maximum crushed rock for pipe bedding for water, sewer, and storm drains, conforming to Section 200-1.2 of the Standard Specifications.

2.4 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

- 1. Survivability: Class 2; AASHTO M 288.
- 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
- 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
- 4. Tear Strength: 56 lbf; ASTM D 4533.
- 5. Puncture Strength: 56 lbf; ASTM D 4833.
- 6. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
- 7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
- 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent;

complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.5 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

3.2 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.3 STAKING AND GRADES:

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

3.4 COMPACTED FILLS:

- A. Excavate the trench to the lines and grades shown on the Drawings with allowance for pipe thickness and for pipe bedding. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade at no additional cost to the Campus with crushed rock. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade.
- B. General: Unless otherwise specified, fill material shall be compacted while at a moisture content near the optimum moisture content and to a density that is not less than [90 percent of] the maximum density determined in accordance with the ASTM D 1557, other methods will not be permitted. Relative compaction shall be as follows:
 - 1. Top 12" subgrade under paved areas: 95%
 - 2. All other areas: 90%

3.5 PREPARING AREAS TO BE FILLED:

- A. Objectionable material shall be removed from the surface upon which the fill is to be placed and loose and porous soil shall be removed and compacted to the depths specified.
- B. After the foundation has been cleared, plowed or scarified, it shall be disced or bladed until it is uniform and free from clods, brought to the proper moisture content and compacted as specified for fill.

3.6 PLACING, SPREADING, AND COMPACTING FILL MATERIAL:

- A. The fill materials shall be placed in layers that when compacted shall not exceed 6". Each layer shall be spread evenly and be thoroughly mixed during the spreading to obtain uniformity of material in each layer.
- B. When the moisture content of the fill material is above that specified, the fill material shall be aerated by the Contractor by blading, mixing or other satisfactory methods until the moisture content is as specified.
- C. When the moisture content of the fill material is below that specified, water shall be added by the Contractor until the moisture content is as specified.

- D. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to the specified density. Compaction shall be accomplished by sheepsfoot rollers, vibratory roller, multiple-wheel pneumatic-tired rollers or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient trips to insure that the desired density has been obtained throughout the entire fill.
- E. After the subgrade has been compacted, the surface shall be reshaped to conform to the drawings and high or low spots eliminated. The finished subgrade shall be thoroughly compacted by rolling, vibrating and tamping to a uniform dense surface. The subgrade shall be protected from displacement by equipment or other operations.
- F. Where fills are constructed on hillsides or slopes, topsoil, slopewash and colluvium shall be removed. Where the exposed slope is steeper than 6 horizontal to 1 vertical, or where specified, the slope on the original ground on which the fill is to be placed shall be stepped or benched. The bottom bench shall be a minimum of 15 feet wide, at least 2 feet deep, and expose firm material over the entire excavation. After excavation of existing ground or removal of unacceptable material at the exposed subgrade, scarify the surface and compact as described above. The Campus's Geotechnical Engineer will be afforded the opportunity to determine the width and frequency of all succeeding benches.
- G. No asphalt concrete, Portland Cement Concrete or any other rubble shall be allowed in fill.

3.7 STRUCTURE EXCAVATION AND BACKFILL:

- A. Structural excavation and backfill shall be done per Sections 300-3.1, 300-3.3, 300-3.4 and 300-3.5 of the Standard Specifications. Jetting shall not be permitted.

3.8 EXCAVATION, GENERAL

- A. Excavate for foundations, pits, trenches, footings, floor slabs, concrete walks to the lines and levels required, shown on the drawings and specified herein, and provide shoring, bracing, cribbing, pumping, and planking required. The bottoms of trenches shall be level, tamped firm, clean and free from debris or foreign matter. Excavations shall be kept free from standing water at all times.
- B. Excavated earth material which is suitable for structural fill or backfill, as determined by the Campus's Representative, shall be conditioned for re-use and properly stockpiled for later filling and backfilling operations. Conditioning shall consist of spreading in layers not to exceed 8 inches. Rocks and aggregate, exceeding 6" in the largest dimension, and deleterious material shall be removed from the site off campus to a legal disposal site.
- C. Abandoned sewers, piping, and other utilities encountered in the progress of the excavation, shall be removed off campus to a legal disposal site.

- D. **Unclassified Excavation:** Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 12 inches outside of concrete forms at footings.
 - b. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - c. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - d. 6 inches beneath bottom of concrete slabs on grade.
 - e. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- E. **Classified Excavation:** Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Campus's Representative. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.
1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 12 inches outside of concrete forms at footings.
 - b. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - c. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - d. 6 inches beneath bottom of concrete slabs on grade.
 - e. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.9 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.10 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.11 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Trench widths in the pipe zone shall be as shown on the Drawings. If no details are shown, maximum width shall be 18 inches greater than the pipe outside diameter. Trench width at the top of the trench will not be limited except where width of excavation would undercut adjacent structures and footings. In such case, width of trench shall be such that there is at least 18 inches between the top edge of the trench and the structure or footing.
- C. Excavate the trench to the lines and grades shown on the Drawings with allowance for pipe thickness and for pipe bedding. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade at no additional cost to the Campus with crushed rock. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade.
- D. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit.
- E. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

F. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.12 LOCATION OF EXCAVATED MATERIAL:

- A. During trench excavation, place the excavated material adjacent to the trench as directed by the Campus's Representative. Do not obstruct any roadways or streets. Conform to federal and state codes governing the safe loading of trenches with excavated material.

3.13 SUBGRADE INSPECTION

- A. Notify Campus's Representative when excavations have reached required subgrade.
- B. If Campus's Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Campus's Representative, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices changes in the Work.
- E. Reconstruct subgrades damaged by rain, accumulated water, or construction activities, as directed by Campus's Representative, without additional compensation.

3.14 UNAUTHORIZED EXCAVATION

- A. Over Excavation: If excavations for foundation work are made deeper than indicated, fill with same concrete as specified for foundation work, without additional expense to Campus. If excavations for foundation work are made wider than indicated, form

footing work or fill with same concrete as specified for foundation work at no additional expense to Campus.

- B. If excavations for slabs or flatwork are made deeper than indicated, fill with coarse, sand to required levels. Compact at optimum moisture content to 90 percent density.
- C. If excavations to greater depths than shown are required by the Geotechnical Engineer in order to reach satisfactory soil bearing conditions, the Campus's Representative is to be notified.
- D. Surplus materials may not be disposed of on site and must be disposed of off campus in a legal disposal area per Section 300-2.6 of the Standard Specifications. Surplus soil may not be exported to a K-12 school site or to a residential site.

3.15 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.16 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud.

3.17 UTILITY TRENCH BACKFILL

- A. Conform to Standard Drawing W-21 for bedding for PVC water, sewer.
- B. Place backfill on subgrades free of mud.
- C. Backfill per the detailed piping specification for the particular type of pipe and per the following.

- D. Place the specified thickness of pipe bedding material over the full width of trench. Grade the top of the pipe bedding ahead of the pipe laying to provide firm, uniform support along the full length of pipe.
- E. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.
- F. After pipe has been bedded, place pipe zone material simultaneously on both sides of the pipe (maximum lift thickness 6") keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during backfilling.
- G. Compact material placing within 12 inches of the outer surface of the pipe by hand tamping only.
- H. Push the backfill material carefully into the backfill previously placed in the pipe zone (maximum lift thickness 6"). Do not permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.
- I. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- J. Unless otherwise shown on the Drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:
 - 1. Pipe zone: 90% relative compaction.
 - 2. Backfill above pipe zone not beneath paving: 90% relative compaction.
 - 3. Backfill above pipe zone in repaved areas: 95% relative compaction for top 24 inches; 90% relative compaction for backfill below 24 inches.
 - 4. Backfill above pipe zone in new pavement areas: 95% relative compaction for top 12 inches; 90% relative compaction for backfill below 12 inches.
- K. Compact trench backfill to the specified relative compaction. Compact by using mechanical compaction or hand tamping. Do not use high impact hammer-type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.
- L. Do not use any axle-driven or tractor-drawn compaction equipment within 5 feet of walls and structures.
- M. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."
- N. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase

piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

- O. Place and compact initial backfill of subbase material free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- P. Controlled Low-Strength Material (CLSM) should have a minimum 28-day compressive strength of 100psi, as recommended in Section 6.1.3 of the Geotechnical Report.
- Q. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- R. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- S. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.18 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud.

3.19 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy.
 - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.20 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.21 MATERIAL REPLACEMENT:

- A. Remove and replace any trenching and backfilling material which does not meet the specifications, at the Contractor's expense.

3.22 FINISH GRADING:

- A. General: Fine grade to bring areas to required lines and grades. The subgrade elevation within the building area for slabs on grade shall be within 1/2" along a 10'-0" straight edge.
- B. Slope finish grades to drain surface water away from buildings, walks. Generally, grade with uniform slope between points where elevations are given, or between such points and existing grades.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- C. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 0.10'.
 - 2. Walks: Plus or minus 0.08'.
 - 3. Pavements: Plus or minus 0.08'.

- D. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.23 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each layer of filter material using two passes of a plate-type vibratory compactor.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each layer of filter material using two passes of a plate-type vibratory compactor.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.24 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Place base course material over subbase course under hot-mix asphalt pavement.
 - 2. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 - 4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not

less than 95 percent of maximum dry unit weight according to ASTM D 698/ASTM D 1557.

3.25 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

3.26 FIELD QUALITY CONTROL

- A. Testing Agency: Campus will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. The Contractor shall conduct his operations to permit tests to be made without interference from his forces and equipment. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. When tests indicate that the density of any layer of fill or portion thereof is below the specified density, such layer or portion shall be re-worked and re-tested until the specified density has been obtained. Re-testing shall be paid for by the Contractor.
- D. No more than two feet of fill in vertical elevation shall be placed without at least one field density test being made within that interval.
- E. Samples: Submit at least one 50-pound composite sample for each 500 cubic yards of embankment material being placed. Samples, in the number directed, shall also be submitted whenever the source or character of the embankment material changes. Each sample shall be taken in three increments from the same truck one increment from the first third of the load, one when half of the load has been dumped, and one from the final third of the load during dumping of the material.
- F. Each sample shall be contained in a clean container which shall be fastened to prevent loss of material. Each sample shall be tagged for identification. The tag shall contain the following information:
 - 1. Project No.
 - 2. Sample No.
 - 3. Date of Sample
 - 4. Sampler

- 5. Source
- 6. Intended Use

- G. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Campus's Representative.
- H. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2099/D 3017, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
 - 4. In paved areas, one density test will be taken for each 2,000 square feet of subgrade in cut.
 - 5. The Campus reserves the right to take more tests as required.
- I. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.27 PROTECTION

- A. During construction, properly graded excavated surfaces to provide positive drainage and prevent ponding of water. Control surface water to avoid damage to adjoining properties, or to finished work on the site. Take remedial measures to prevent erosion of freshly graded areas and slopes, until such time as permanent drainage and erosion control measures have been installed.
- B. After completion of grading and the Campus's Representative has finished observations of the work, no further excavation or filling shall be done except under the observation of the Campus's Representative.
- C. Erosion prevention shall continue through the duration of the project. Any debris or washouts deposited at bottom of slope of graded areas shall be replaced immediately and reworked to proper compaction requirements.
- D. Protecting Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- E. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Campus's Representative; reshape and recompact.
- F. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
 2. Protect open excavations, trenches, and the like with fences, covers, and railings as required to maintain safe pedestrian and vehicular traffic passage. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.28 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Campus's property.

3.29 EXISTING UTILITIES:

- A. Existing utilities are shown from available records and the accuracy of their location cannot be guaranteed. The Contractor shall pothole as necessary to locate horizontally and vertically all existing utilities. Any discrepancy from the plans shall be reported to the Campus's Representative immediately. The Contractor shall be responsible for all costs due to discrepancies in the location of existing utilities if the Contractor fails to pothole and locate existing utilities and notify the Campus's Representative of discrepancies prior to start of construction.
- B. Abandoned utilities encountered during all construction operations shall be removed as required to complete all work shown on plans.
- C. Live utilities shall remain in service at all times unless otherwise noted.

3.30 COMPLETION REQUIREMENTS:

- A. Cleanup: Leave entire graded portions of the site "rake-clean".
- B. Disposal: Pick up and transport unsuitable, deleterious, excess material, and debris to an off-site legal disposal area.

END OF SECTION 31 20 00

SECTION 31 22 00

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks, pavements.
5. Subbase and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling for utility trenches.
8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 1 Section "Allowances" for quantity allowance provisions related to unit-price rock excavation and authorized additional excavation.
2. Division 1 Section "Unit Prices" for unit-price rock excavation and authorized additional excavation provisions.
3. Division 1 Section "Field Engineering" for recording preexcavation and earthwork progress.
4. Division 1 Section "Construction Facilities and Temporary Controls" for temporary controls, utilities, and support facilities.
5. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
6. Division 2 Section "Tree Protection and Trimming" for protecting and trimming trees to remain.
7. Division 2 Section "Subdrainage" for drainage of walls and landscaped areas.
8. Division 3 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
9. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.2 UNIT PRICES

A. Unit prices for earthwork are included in Division 1 Section "Unit Prices."

B. Quantity allowances for earthwork are included in Division 1 Section "Allowances."

1.3 REFERENCED STANDARDS:

- A. The editions, specifications and standards referenced herein, published by the following organizations apply to the construction only to the extent specified by the reference.
- B. Standard Specifications:
 - 1. Standard Specifications for Public Works Construction (current edition).
 - 2. Standard Special Provisions of the Regional Standards Committee.
 - 3. City of San Diego Standard Special Provisions, Document No. 769345 (current edition).
 - 4. California Department of Transportation, "Manual of Traffic Controls, for Construction and Maintenance Work Zones", (current edition), Document No. 869159.
- C. Standard Drawings:
 - 1. City of San Diego Standard Drawings, Document No. 769374 (current edition).
- D. The publications listed below form a part of this specification to the extent referenced. The publications are referred to the text by basis designation only.
 - 1. American Society for Testing and Materials (ASTM) Publications:
 - 2. C 33-86 Concrete Aggregates
 - 3. C 136-84a Sieve Analysis of Fine and Coarse Aggregates
 - 4. D 4318-84 Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 5. D 1140-54 Amount of Material in Soils Finer than the (R 1971)No. 200 (75 micrometer) Sieve
 - 6. D 1556-82 Density of Soil Place by Sand Cone Method (R 1974)
 - 7. D 1557-78 Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 kg) Rammer and 18-in. (457mm) drop
 - 8. D 2103-81 Polyethylene Film and Sheeting
 - 9. D 2419-74 Sand Equivalent Value of Soils and Fine Aggregates (R 1979)
 - 10. D 2487-85 Classification of Soils for Engineering Purposes
 - 11. D 2922-81 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- E. D 3017-78Moisture Content of Soil and Soil-Aggregate in place by Methods (Shallow Depth)

1.4 DELIVERY AND STORAGE:

- A. Deliver and store materials in a manner to prevent contamination or segregation.

1.5 RECORDS OF INVESTIGATION:

- A. Refer to "Information Available to Bidders".

1.6 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Campus's Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Campus's Representative. Unauthorized excavation, as well as remedial work directed by Campus's Representative, shall be without additional compensation.
- G. Pipe Zone: The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level 12 inches above the top of the pipe. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipes to a horizontal level above the top of the highest or topmost pipe. Thickness of pipe zone above the highest top of pipe shall be as described above unless otherwise shown on the Drawings or otherwise described in the specifications for the particular type of pipe installed.
- H. Pipe Bedding: The pipe bedding shall be defined as a layer of material below the bottom of the pipe or conduit as shown on the Drawings and extending over the full trench width in which the pipe is bedded. Use a minimum thickness of 6 inches for the pipe bedding unless otherwise shown on the Drawings or otherwise described in the specifications for the particular type of pipe installed.
- I. Fill: Soil materials used to raise existing grades.
- J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for

footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- K. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- M. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- N. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.7 SUBMITTALS

- A. Product Data: For the following:
1. Each type of plastic warning tape.
 2. Geotextile.
 3. Controlled low-strength material, including design mixture.
 4. Geofoam.
- B. Samples: 12-by-12-inch Sample of subdrainage geotextile.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 698/ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.

- D. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.8 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Quality Control."

1.9 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Campus or others unless permitted in writing by Campus's Representative and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Campus's Representative not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Campus's Representative's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Materials for compact fill shall consist of any soil imported or excavated from the cut areas. The soil shall contain no rocks or hard lumps greater than 6 inches in maximum dimension and shall contain at least 40% of material smaller than 1/2 inch in size. Material of perishable, spongy, or otherwise improper nature shall not be used in fills. Asphalt concrete pieces shall not be used in fill.
- B. Native earth backfill used above the pipe zone shall be excavated, non-expansive, fine-grained material free of roots, debris, and rocks larger than 3 inches.
- C. Materials placed within 36 inches of rough grade shall be select material as specified in Part 1 above. The material shall not swell more than 3% when compacted to 90% relative compaction in accordance with ASTM D 1557 under an axial load of 160 psf.

- D. Representative samples of material to be used for fill shall be tested in the laboratory in the order to determine the maximum density, optimum moisture content and classification of the soil.
- E. During the grading operations, soil types other than those analyzed in the report of the soil investigation may be encountered. The Campus's Geotechnical Engineer shall be consulted to determine the suitability of these soils.
- F. Fill material to be used under the building, slabs, pavement, and structures shall be on-site or imported material, conforming to the above. Excavated on-site material will be considered suitable for structural fill if it is free from organic matter and other deleterious substances and conforms to the requirements specified above. No material shall be placed without the approval of the Campus's Representative under the direction of the Campus's Geotechnical Engineer.
- G. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- H. Satisfactory Soils: [ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM] [AASHTO M 145 Soil Classification Groups A-1, A-2-4, A-2-5, and A-3], or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- I. Unsatisfactory Soils: Soil Classification Groups [GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487] [A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145], or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- J. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
 - 1. Base Course: Aggregates for base course shall conform to Section 26 of the Standard Specifications, Class 2 for 3/4 inch maximum size gradation.
- K. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- L. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- M. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

- N. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- O. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- P. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 IMPORTED SAND - PIPE ZONE:

- A. Imported sand used in the pipe zone or for the pipe base shall have the following gradation:

1.	Sieve Size	Percent Passing By Weight
	1) 3/8 inch	100
	2) No. 4	75 - 100
	3) No. 30	12 - 50
	4) No. 100	5 - 20
	5) No. 200	0 - 10

2.3 CRUSHED ROCK:

- A. Use a 3/4 inch maximum crushed rock for pipe bedding for water, sewer, and storm drains, conforming to Section 200-1.2 of the Standard Specifications.

2.4 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

- 1. Survivability: Class 2; AASHTO M 288.
- 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
- 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
- 4. Tear Strength: 56 lbf; ASTM D 4533.
- 5. Puncture Strength: 56 lbf; ASTM D 4833.
- 6. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
- 7. Permittivity: 0.5 per second, minimum; ASTM D 4491.
- 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

- 1. Survivability: Class 2; AASHTO M 288.

2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.5 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

3.2 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.3 STAKING AND GRADES:

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

3.4 COMPACTED FILLS:

- A. Excavate the trench to the lines and grades shown on the Drawings with allowance for pipe thickness and for pipe bedding. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade at no additional cost to the Campus with crushed rock. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade.
- B. General: Unless otherwise specified, fill material shall be compacted while at a moisture content near the optimum moisture content and to a density that is not less than the maximum density determined in accordance with the ASTM D 1557 or other density methods that will obtain equivalent results. Relative compaction shall be as follows:
 - 1. Top 12" subgrade under paved areas: 95%
 - 2. All other areas: 90%

3.5 PREPARING AREAS TO BE FILLED:

- A. Objectionable material shall be removed from the surface upon which the fill is to be placed and loose and porous soil shall be removed and compacted to the depths specified.
- B. After the foundation has been cleared, plowed or scarified, it shall be disced or bladed until it is uniform and free from clods, brought to the proper moisture content and compacted as specified for fill.

3.6 PLACING, SPREADING, AND COMPACTING FILL MATERIAL:

- A. The fill materials shall be placed in layers that when compacted shall not exceed 6". Each layer shall be spread evenly and be thoroughly mixed during the spreading to obtain uniformity of material in each layer.
- B. When the moisture content of the fill material is above that specified, the fill material shall be aerated by the Contractor by blading, mixing or other satisfactory methods until the moisture content is as specified.
- C. When the moisture content of the fill material is below that specified, water shall be added by the Contractor until the moisture content is as specified.

- D. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to the specified density. Compaction shall be accomplished by sheepsfoot rollers, vibratory roller, multiple-wheel pneumatic-tired rollers or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient trips to insure that the desired density has been obtained throughout the entire fill.
- E. After the subgrade has been compacted, the surface shall be reshaped to conform to the drawings and high or low spots eliminated. The finished subgrade shall be thoroughly compacted by rolling, vibrating and tamping to a uniform dense surface. The subgrade shall be protected from displacement by equipment or other operations.
- F. Where fills are constructed on hillsides or slopes, topsoil, slopewash and colluvium shall be removed. Where the exposed slope is steeper than 6 horizontal to 1 vertical, or where specified, the slope on the original ground on which the fill is to be placed shall be stepped or benched. The bottom bench shall be a minimum of 15 feet wide, at least 2 feet deep, and expose firm material over the entire excavation. After excavation of existing ground or removal of unacceptable material at the exposed subgrade, scarify the surface and compact as described above. The Campus's Geotechnical Engineer will be afforded the opportunity to determine the width and frequency of all succeeding benches.
- G. No asphalt concrete, Portland Cement Concrete or any other rubble shall be allowed in fill.

3.7 STRUCTURE EXCAVATION AND BACKFILL:

- A. Structural excavation and backfill shall be done per Sections 300-3.1, 300-3.3, 300-3.4 and 300-3.5 of the Standard Specifications. Jetting shall not be permitted.

3.8 EXCAVATION, GENERAL

- A. Excavate for foundations, pits, trenches, footings, floor slabs, concrete walks to the lines and levels required, shown on the drawings and specified herein, and provide shoring, bracing, cribbing, pumping, and planking required. The bottoms of trenches shall be level, tamped firm, clean and free from debris or foreign matter. Excavations shall be kept free from standing water at all times.
- B. Excavated earth material which is suitable for structural fill or backfill, as determined by the Campus's Representative, shall be conditioned for re-use and properly stockpiled for later filling and backfilling operations. Conditioning shall consist of spreading in layers not to exceed 8 inches. Rocks and aggregate, exceeding 6" in the largest dimension, and deleterious material shall be removed from the site off campus to a legal disposal site.
- C. Abandoned sewers, piping, and other utilities encountered in the progress of the excavation, shall be removed off campus to a legal disposal site.

- D. **Unclassified Excavation:** Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 12 inches outside of concrete forms at footings.
 - b. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - c. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - d. 6 inches beneath bottom of concrete slabs on grade.
 - e. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- E. **Classified Excavation:** Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Campus's Representative. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.
1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 12 inches outside of concrete forms at footings.
 - b. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - c. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - d. 6 inches beneath bottom of concrete slabs on grade.
 - e. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.9 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.10 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.11 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Trench widths in the pipe zone shall be as shown on the Drawings. If no details are shown, maximum width shall be 18 inches greater than the pipe outside diameter. Trench width at the top of the trench will not be limited except where width of excavation would undercut adjacent structures and footings. In such case, width of trench shall be such that there is at least 18 inches between the top edge of the trench and the structure or footing.
- C. Excavate the trench to the lines and grades shown on the Drawings with allowance for pipe thickness and for pipe bedding. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade at no additional cost to the Campus with crushed rock. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade.
- D. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit.
- E. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

F. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.12 LOCATION OF EXCAVATED MATERIAL:

- A. During trench excavation, place the excavated material adjacent to the trench as directed by the Campus's Representative. Do not obstruct any roadways or streets. Conform to federal and state codes governing the safe loading of trenches with excavated material.

3.13 SUBGRADE INSPECTION

- A. Notify Campus's Representative when excavations have reached required subgrade.
- B. If Campus's Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Campus's Representative, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices changes in the Work.
- E. Reconstruct subgrades damaged by rain, accumulated water, or construction activities, as directed by Campus's Representative, without additional compensation.

3.14 UNAUTHORIZED EXCAVATION

- A. Over Excavation: If excavations for foundation work are made deeper than indicated, fill with same concrete as specified for foundation work, without additional expense to Campus. If excavations for foundation work are made wider than indicated, form

footing work or fill with same concrete as specified for foundation work at no additional expense to Campus.

- B. If excavations for slabs or flatwork are made deeper than indicated, fill with coarse, sand to required levels. Compact at optimum moisture content to 90 percent density.
- C. If excavations to greater depths than shown are required by the Geotechnical Engineer in order to reach satisfactory soil bearing conditions, the Campus's Representative is to be notified.
- D. Surplus materials may not be disposed of on site and must be disposed of off campus in a legal disposal area per Section 300-2.6 of the Standard Specifications. Surplus soil may not be exported to a K-12 school site or to a residential site.

3.15 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.16 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud.

3.17 UTILITY TRENCH BACKFILL

- A. Conform to Standard Drawing W-21 for bedding for PVC water, sewer.
- B. Place backfill on subgrades free of mud.
- C. Backfill per the detailed piping specification for the particular type of pipe and per the following.

- D. Place the specified thickness of pipe bedding material over the full width of trench. Grade the top of the pipe bedding ahead of the pipe laying to provide firm, uniform support along the full length of pipe.
- E. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.
- F. After pipe has been bedded, place pipe zone material simultaneously on both sides of the pipe (maximum lift thickness 6") keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during backfilling.
- G. Compact material placing within 12 inches of the outer surface of the pipe by hand tamping only.
- H. Push the backfill material carefully into the backfill previously placed in the pipe zone (maximum lift thickness 6"). Do not permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.
- I. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- J. Unless otherwise shown on the Drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:
 - 1. Pipe zone: 90% relative compaction.
 - 2. Backfill above pipe zone not beneath paving: 90% relative compaction.
 - 3. Backfill above pipe zone in repaved areas: 95% relative compaction for top 24 inches; 90% relative compaction for backfill below 24 inches.
 - 4. Backfill above pipe zone in new pavement areas: 95% relative compaction for top 12 inches; 90% relative compaction for backfill below 12 inches.
- K. Compact trench backfill to the specified relative compaction. Compact by using mechanical compaction or hand tamping. Do not use high impact hammer-type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.
- L. Do not use any axle-driven or tractor-drawn compaction equipment within 5 feet of walls and structures.
- M. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."
- N. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase

piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

- O. Place and compact initial backfill of subbase material free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- P. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.
- Q. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- R. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- S. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- T. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.18 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud.

3.19 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy.
 - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.20 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than **[8 inches] <Insert dimension>** in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698/ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.21 MATERIAL REPLACEMENT:

- A. Remove and replace any trenching and backfilling material which does not meet the specifications, at the Contractor's expense.

3.22 FINISH GRADING:

- A. General: Fine grade to bring areas to required lines and grades. The subgrade elevation within the building area for slabs on grade shall be within 1/2" along a 10'-0" straight edge.
- B. Slope finish grades to drain surface water away from buildings, walks. Generally, grade with uniform slope between points where elevations are given, or between such points and existing grades.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- C. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 0.10'.
 - 2. Walks: Plus or minus 0.08'.
 - 3. Pavements: Plus or minus 0.08'.

- D. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.23 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.24 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Place base course material over subbase course under hot-mix asphalt pavement.
 - 2. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 - 4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698 /ASTM D 1557.

- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698/ ASTM D 1557.

3.25 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.26 FIELD QUALITY CONTROL

- A. Testing Agency: Campus will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. The Contractor shall conduct his operations to permit tests to be made without interference from his forces and equipment. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. When tests indicate that the density of any layer of fill or portion thereof is below the specified density, such layer or portion shall be re-worked and re-tested until the specified density has been obtained. Re-testing shall be paid for by the Contractor.
- D. No more than two feet of fill in vertical elevation shall be placed without at least one field density test being made within that interval.
- E. Samples: Submit at least one 50-pound composite sample for each 500 cubic yards of embankment material being placed. Samples, in the number directed, shall also be submitted whenever the source or character of the embankment material changes. Each sample shall be taken in three increments from the same truck one increment from the first third of the load, one when half of the load has been dumped, and one from the final third of the load during dumping of the material.

- F. Each sample shall be contained in a clean container which shall be fastened to prevent loss of material. Each sample shall be tagged for identification. The tag shall contain the following information:
 - 1. Project No.
 - 2. Sample No.
 - 3. Date of Sample
 - 4. Sampler
 - 5. Source
 - 6. Intended Use
- G. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Campus's Representative.
- H. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2099/D 3017, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
 - 4. In paved areas, one density test will be taken for each 2,000 square feet of subgrade in cut.
 - 5. The Campus reserves the right to take more tests as required.
- I. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.27 PROTECTION

- A. During construction, properly graded excavated surfaces to provide positive drainage and prevent ponding of water. Control surface water to avoid damage to adjoining properties, or to finished work on the site. Take remedial measures to prevent erosion of freshly graded areas and slopes, until such time as permanent drainage and erosion control measures have been installed.
- B. After completion of grading and the Campus's Representative has finished observations of the work, no further excavation or filling shall be done except under the observation of the Campus's Representative.
- C. Erosion prevention shall continue through the duration of the project. Any debris or washouts deposited at bottom of slope of graded areas shall be replaced immediately and reworked to proper compaction requirements.

- D. Protecting Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- E. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Campus's Representative; reshape and recompact.
- F. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
 - 2. Protect open excavations, trenches, and the like with fences, covers, and railings as required to maintain safe pedestrian and vehicular traffic passage. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.28 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Campus's property.

3.29 EXISTING UTILITIES:

- A. Existing utilities are shown from available records and the accuracy of their location cannot be guaranteed. The Contractor shall pothole as necessary to locate horizontally and vertically all existing utilities. Any discrepancy from the plans shall be reported to the Campus's Representative immediately. The Contractor shall be responsible for all costs due to discrepancies in the location of existing utilities if the Contractor fails to pothole and locate existing utilities and notify the Campus's Representative of discrepancies prior to start of construction.
- B. Abandoned utilities encountered during all construction operations shall be removed as required to complete all work shown on plans.
- C. Live utilities shall remain in service at all times unless otherwise noted.

3.30 COMPLETION REQUIREMENTS:

- A. Cleanup: Leave entire graded portions of the site "rake-clean".
- B. Disposal: Pick up and transport unsuitable, deleterious, excess material, and debris to an off-site legal disposal area.

END OF SECTION 31 22 00

SECTION 31 23 16

EXCAVATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCES

- A. ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.
- B. California Public Contract Code, Section 7104 - Public Works Contracts for Digging Trenches or Excavations; Notice on Discovery of Hazardous Waste or Other Unusual Conditions; Investigations; Change Orders; Effect on Contract.

1.03 SUBMITTALS

- A. Compaction Report indicating requirements per ASTM D1556.
- B. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.04 QUALITY ASSURANCE

- A. Verify that survey benchmark and intended elevations for the Work are as indicated.
- B. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
 - 1. Testing Frequency
 - a. For borrow up to 1,000-cu.yrd, conduct 1 test for each 250-cu.yrds.
 - b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
 - c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.
 - 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
 - 3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.

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4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
5. Do not import soils, that exhibit a known risk to human health, the environment, or both.

1.05 SOILS INFORMATION

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

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 PREPARATION

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

3.02 EXCAVATION FOR FOUNDATIONS

- A. Conform to Public Contract Code, Section 7104 for excavations that extend more than four feet below the surface.
- B. Conform to Section 6705, Labor Code. Provide shoring and bracing plan or other provisions intended to prevent caving ground.
- C. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases. Protect existing monuments, grades and improvements of any kind. Remove all obstructions to the work.

- D. Excavate subsoil to elevations required to accommodate building foundations, slabs-on-grade, construction operations, forms, forms removal and inspection.
 - 1. Side forms in foundation excavations may be omitted where earth remains firm with no cave-in providing one inch is added to footing width for each form removed.
 - 2. Finish subgrade to a tolerance of 0.05 foot of within required elevations for subgrade.
- E. Machine slope banks. Earth banks shall be sloped to 2 (horizontal) to 1 (vertical). Tops of earth banks shall be level to a distance of 5 feet minimum from all existing structures, and 5 feet minimum behind all construction barricades adjacent to driveways.
- F. Excavation cut shall not interfere with normal 45 degree bearing splay of foundation.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- H. Hand trim excavation. Remove loose matter. Machine tamp bottom of excavation.
- I. Remove lumped subsoil, boulders, and rock 3 inches in size or larger.
- J. Notify Geotechnical Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- K. Correct unauthorized excavation.
- L. Correct areas over-excavated by error by filling with the specified concrete.
- M. Stockpile approved excavated material in area designated on site and remove excess material not being reused from site.
- N. Bulkheads and shoring shall conform to Title 8, Industrial Relations, California Code of Regulations, Construction Safety Orders.

3.03 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent Geotechnical Engineer Testing Laboratory to perform field quality-control testing and inspections. Do not proceed with concrete placement without approval of Geotechnical Engineer.
- B. Testing agency will test compaction of soils in place according to ASTM D1556, and ASTM D2937 as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of building slab, but in no case fewer than 3 tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.

- C. Frequency of Tests: Geotechnical Engineer Testing Laboratory may make as many tests as are necessary to ensure specified results.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.04 PROTECTION

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

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCES

- A. ASTM C150 - Portland Cement.
- B. ASTM C494 - Chemical Admixtures for Concrete.
- C. ASTM D1557 - Laboratory compaction characteristics of soil using modified effort.
- D. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.
- E. California Code of Regulations, Title 8, Industrial Relations, Construction Safety Orders, Division 01, Chapter 4, Sub-Chapter 4, Article 6 Excavations.
- F. California Public Contract Code, Section 7104 - Public Works Contracts for Digging Trenches or Excavations; Notice on Discovery of Hazardous Waste or Other Unusual Conditions; Investigations; Change Orders; Effect on Contract.
- G. California Labor Code, Section 6705 - Public Works Contracts requiring detailed plans for shoring, bracing, sloping, indicating protection from caving ground for trenching work in excess of 5' deep and contract amounts stipulated therein.

1.03 QUALITY ASSURANCE

- A. Verify survey benchmark and intended elevations for Work.
- B. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
 - 1. Testing Frequency
 - a. For borrow up to 1,000-cu.yd, conduct 1 test for each 250-cu.yrds.

- b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
- c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.
- 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
- 3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
- 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
- 5. Do not import soils that exhibit a known risk to human health, the environment, or both.

1.04 SOILS INFORMATION

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

PART 2 - PRODUCTS

2.01 FILL AND BEDDING MATERIALS

- A. Sand: Sand shall consist of natural or manufactured granular material, or a combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended. Conform to Subsection 200-1.5.5, SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.
- B. Imported Fill: Granular, free of debris, no gravel larger than 3 inches in any dimension, non-expansive, approved by the Architect prior to placement on the site.
- C. Slurry Concrete:
 - 1. Slump: Between 4 inches and 6 inches.
 - 2. Aggregate: 40 percent sand by weight, 60 percent pea gravel, minimum 1/4 inch, maximum 5/8 inch.
 - 3. Portland Cement: ASTM C150, 2-sack mix (2 sacks of cement per cubic yard).]
 - 4. Admixture: Calcium Chloride free, in proportions not to exceed the manufacturer's recommendations.
 - 5. Artificial Coloring: ASTM C494. Mix in Mapico Red pigment, proportions as recommended by the manufacturer, L.M. Scofield or equal.

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- 6. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Material shall be mechanically mixed until the cement and water are thoroughly dispersed.
 - D. Stockpiled Fill: Onsite soils, stored separately on the site, approved for re-use by the Architect.
 - E. Thrust Blocks: Concrete per Section 32 13 13.
- 2.02 ACCESSORIES
- A. Underground Warning Tape: Metallic Detection Tape, aluminum core, 6 inches wide AASHTO specification colors, by Safety Sign Company, Cleveland, OH, or equal.
 - B. Color Coding and Lettering: as required for type of underground utility.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 EXCAVATION

- A. Conform to Construction Safety Orders, Title 8, CCR, For Sloping, Benching, Shoring, Bracing, Protective Systems, and Shafts.
- B. Conform to Section 7104, Public Contract Code. Promptly notify Owner of any contact with hazardous materials or differing conditions.
- C. Conform to Section 6705, Labor Code. Provide shoring and bracing plan or other provisions intended to prevent caving ground.
- D. Excavate subsoil required for utilities. Trenches shall be level or parallel to finish grade unless designated on drawings to be installed to specific gradient.
- E. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

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- F. Water, storm drainage piping located in the same trench shall be separated by 12 inches horizontally and vertically, and water line shall be placed on a solid shelf excavated on one side of the common trench. Cross-over water lines shall also be separated 12 inches vertically from storm drainage pipe.
- G. Water and sewer piping shall not be located in the same trench and they shall be separated by 12 inches horizontally and 12 inches vertically.
- H. Excavation shall not interfere with normal 45 degree bearing splay of foundations. Parallel trenches, no closer than 18 inches from building foundations.
- I. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- J. Remove lumped subsoil, boulders and rock.
- K. Correct unauthorized excavation.
- L. Stockpile approved excavated material in area designated on site and remove excess material not being used from site.

3.04 BEDDING

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

3.05 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen materials.
- B. Fill areas will be inspected, tested and approved by Geotechnical Engineer.
- C. Soil Fill over Bedding: Place and compact material in continuous layers as scheduled, compacted to ASTM D1557.
- D. Employ placement method that does not disturb or damage conduit, ducts or piping in trench.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density. When operations are interrupted by rain, do not resume Work until field tests indicate that moisture content and density of fill are as previously specified.
- F. Remove surplus backfill materials from site and dispose legally.
- G. Leave fill material stockpile areas completely free of excess fill materials.
- H. Minimum Cover Over Piping, Conduits or Duct Banks: 24 inches.

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- I. Lay out and install or otherwise confirm invert elevations of all gravity flow systems to avoid conflict with other sub-surface structures or utilities of any kind. Adjust elevations or layout of pipes, conduits or duct banks to permit the required gravity flow.
- J. Jetting for utility trenching compaction may be used outside building perimeter and only when recommended by Geotechnical Engineer, in accordance with Section 306 SSPWC.
- K. Pressurized piping shall be installed level, or shall be installed parallel to finish grades unless designated on the Drawings to be installed to specific gradients.

3.06 THRUST BLOCKS

- A. Install at turns of water lines and as indicated in drawings.

3.07 TOLERANCES

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

3.08 FIELD QUALITY CONTROL

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

3.09 PROTECTION OF FINISHED WORK

- A. Protect finished Work.
- B. Recompact fills subjected to vehicular traffic.

3.010 TEMPORARY PROTECTION OF UNFINISHED WORK

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

3.011 SCHEDULE

- A. Storm and Sanitary Piping:
 - 1. Bedding Fill: Sand, minimum thickness below piping 0.4 times outside diameter of pipe but no less than 4 inches. Minimum thickness above top of piping, 12 inches, compacted to 90 percent.
 - 2. Cover with stockpiled fill in 8-inch lifts to specified subgrade elevations, compact to 90 percent or to 95 percent under vehicle traffic-supporting paved areas.
 - 3. Fill: Slurry concrete, 6" cover at top, bottom and sides of pipes at exterior paved areas (at vehicle traffic) where minimum fill cover is less than 12" below finished elevation of paving.
 - 4. Bury warning tape marked "Caution Sewer Line" 12 inches above all concrete-encased piping. Align tape parallel to and within 3 inches of the centerline of the piping.
- B. Power Ducts: Concrete Encased
 - 1. Fill: Slurry concrete, 3 inches cover at top, bottom, between conduits and sides of duct bank.
 - 2. Fill: Slurry concrete, 6 inches cover at top, bottom and sides of duct bank conduit at exterior paved areas where minimum fill cover is less than 24" below finished elevation of paving, less than 12" below finished elevations of interior floor slabs and at building footings where conduit is in the footing structural splay.
 - 3. Install two No. 4 bars in slurry concrete at top of bank under paved areas, minimum 3 inch concrete cover.
 - 4. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or to 95 percent under traffic-supporting paved areas.
 - 5. Bury warning tape marked "Caution Buried High Voltage Line" 12 inches above all concrete-encased duct banks. Align tape parallel to and within 3 inches of the centerline of the duct bank.
- C. Water Piping and Gas Piping:
 - 1. Bedding Fill: Sand, minimum thickness below piping 0.4 times outside diameter of pipe but not less than 4". Minimum thickness above top of piping, 6 inches, compacted to 90 percent.
 - 2. Fill: Slurry concrete, 6 inches cover at top, bottom and sides of pipes at exterior paved areas where minimum fill cover is less than 24" below finished elevation of paving, and less than 12" below finished elevations of interior floor slabs and at building footings where piping is in the footing structural splay.
 - 3. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
 - 4. Observe joints at pressure tests.
 - 5. Bury warning tape marked "Caution Buried Gas (or "Pipeline") Line" 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.
- D. Fire Lines:
 - 1. Bedding Fill: Manufactured Sand, minimum 6" thickness under piping, minimum thickness above top of piping and sides, 6", compact to 90 percent.
 - 2. Fill: Slurry concrete, 6" cover at top pipes at exterior paved areas where minimum fill cover is less than 24" below finished elevation of paving.

3. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
 4. Bury warning tape marked "Caution Buried Pipeline" 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.
- E. Low Voltage Conduits and Communications: Direct Burial Minimum trench depth 36 inches.
1. Bedding Fill: Sand, 6 inches at bottom, sides and 12 inches on top, compacted to 95 percent.
 2. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
 3. Bury warning tape marked "Caution Buried Communication Line Below" 12 inches above conduits. Align tape parallel to and within 3 inches of the centerline of conduits.

END OF SECTION 31 23 17

SECTION 31 23 23

BACKFILLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

1.02 REFERENCES

- A. ASTM D1557 - Laboratory compaction characteristics of soil using modified effort.
- B. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.
- C. Chapter 18A and 33, California Building Code.
- D. CSS - Caltrans Standard Specifications, Latest Edition.

1.03 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each [on-site] [and] [borrow] soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 1557 for each on-site [and] [borrow] soil material proposed for fill and backfill.
- B. [Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.]

1.04 QUALITY ASSURANCE

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

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

PART 2 - PRODUCTS

2.01 FILL MATERIALS

- A. This Section establishes standards of quality for backfill materials to be used as approved by Geotechnical Engineer in accordance with Chapter 18A CBC, Section 1803A.2 and Appendix J Section J107, California Building Code, and as scheduled in other Sections of this specification.
- B. Crushed Rock and Rock Dust: Crushed rock and rock dust shall be product of crushing rock or gravel. Portion of material that is retained on a 3/8 inch sieve shall contain at least 50 percent of particles having three or more fractured faces. Not over 5 percent shall be pieces that show no such faces resulting from crushing. Of that portion which passes 3/8 inch sieve but is retained on No. 4 sieve, not more than 10 percent shall be gravel particles. Crushed rock shall conform to 3/4 inch sieve size in accordance with Subsection 200-1.2, SSPWC, Crushed Rock Gradation Table.
- C. Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded to the following:
 1. Minimum Size: 1/4 inch.
 2. Maximum Size: 5/8 inch.
- D. Sand: Sand shall consist of manufactured granular material, or combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for purpose intended. Conform to Section 200-1.5.5, SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.
- E. Crushed Aggregate Base: As specified in Section 32 12 16 . Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, with 3/8 inch sieve requirement waived, or Class 2 aggregate base as defined in Section 26, CSS.
- F. Imported Fill: Clean granular, free of debris, no rock larger than 3 inches in any dimension, non-expansive, approved by Geotechnical Engineer prior to placement on site.

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- G. Concrete: Structural, as specified in Section 03 30 00.
- H. Concrete Slurry: as specified in Section 31 23 17.
- I. Stockpiled Fill: On-site soils, stored separately on site, approved for re-use by Geotechnical Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 BACKFILLING

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

3.03 TOLERANCES

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- A. Top Surface of Backfilling Subgrade: Within 0.05 feet from required elevations.

3.04 FIELD QUALITY CONTROL

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

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished Work.
- B. Recompact fills subjected to and damaged by vehicular traffic.

END OF SECTION

SECTION 31 63 29

CAST-IN-PLACE DRILLED HOLE PILES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes:
 - 1. Dry-installed drilled piers.
 - 2. Slurry displacement-installed drilled piers.
 - 3. Dry-installed or slurry displacement-installed drilled piers, at Contractor's choice.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast in Place Concrete" for general structural and building applications of concrete.
 - 2. Division 03 Section "Concrete Reinforcement."

1.03 REFERENCES

- A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.
- B. American Concrete Institute (ACI): Use applicable year of adoption or revision as published in the "ACI Manual of Concrete Practice".
 - 1. ACI 336.1: Standard Specification for the Construction of Drilled Piers.
- C. American Society for Testing and Materials (ASTM): Use applicable year of adoption or revision as published in the "Annual Book of ASTM Standards".
 - 1. ASTM A 252: Specification for Welded and Seamless Pipe Piles.
 - 2. ASTM A 36: Standard Specification for Carbon Structural Steel.
- D. CBC: 2016 California Building Code
- E. Evaluation Report: Where designated in this Section, products shall have an active Evaluation Report evidencing compliance with provisions of the International Building Code. Reports are available at www.icc-es.org and www.iapmoes.org.

- F. Geotechnical Report:

1.04 SUBMITTALS

- A. Submittal procedures and administrative provisions are established by Division 01 Section "Submittals".

- B. Product Data: For each type of product indicated.
- C. Design Mixes: For each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Shop Drawings: For concrete reinforcement detailing fabricating, bending, and placing.
- E. Shaft Drilling Reports: Record of as-built pier location, diameter, tip elevation, cut off elevation, reinforcing and concrete placement.
- F. Submit pier installation and proposed temporary shaft protection plan to the Owner's Geotechnical Engineer at least four weeks prior to mobilization.
 - 1. The installation and shaft protection plan shall provide information on the following:
 - a. Name and experience record of the drilled pier superintendent who will be in charge of drilled pier operations for the project.
 - b. List of proposed equipment to be used, including cranes, drills, augers, bailing buckets, final cleaning equipment, de-sanding equipment, slurry pumps, core sampling equipment, tremies, concrete pumps, casing.
 - c. Details of overall construction operation sequence and the sequence and schedule of shaft construction.
 - d. Details of shaft excavation methods.
 - e. When the use of slurry is anticipated, details of the mix design and its suitability for the subsurface conditions at the construction site, mixing and storage methods, maintenance methods, disposal procedures, slurry mixing procedures, pumping and handling equipment, testing procedures, slurry cleaning procedures, recycling and disposal procedures.
 - f. Details of methods to clean the shaft excavation.
 - g. Details of reinforcement placement, including support and centralization methods.
 - h. Details of concrete placement, including proposed operational procedures for free fall, tremie or pumping methods.
 - i. Details of casing installation and removal methods.
 - 2. The Geotechnical Engineer will evaluate the drilled pier installation plan for conformance with the plans, specifications and special provisions. Within 14 days after receipt of the installation plan, the Geotechnical Engineer will notify the contractor of any additional information required and or changes necessary to meet the contract requirements. All procedural approvals given by the Geotechnical Engineer shall be subject to trial in the field and shall not relieve the Contractor of the responsibility to satisfactorily complete the work as detailed in the plans and specifications.
- G. Submit a survey plan locating new drilled piers after installation. Actual pier locations and pier reinforcement to be coordinated with pier cap reinforcement.
- H. Submit a concrete placement procedure for drilled piers for 30 minutes maximum interruption of placement. The procedure shall include a contingency plan that gives an additional 15 minutes of interruption of placement.

1.05 QUALITY ASSURANCE

- A. Contractor Qualifications:
 - 1. Minimum of 3 successful projects with similar soil conditions, shaft sizes, depth and volumes of work contained in this project. As per the geotechnical report, the contractor shall have a minimum of 8 years of experience.
 - 2. Submit proof of compliance within 30 days after "Notice to Proceed."
- B. Survey Work: Engage a California licensed land surveyor to perform surveys, layouts and measurements for drilled pier work.
 - 1. Conduct layout work for each pier to lines and levels required before excavation and actual measurements of each pier's horizontal axial location, shaft diameter, bottom and top elevations, deviations from specified tolerances and other data as required.
 - 2. Record and maintain information pertinent to each pier and cooperate with other testing and inspection personnel to provide data required for reports.
 - 3. The Owner's Geotechnical Engineer will inspect shafts prior to and after the installation of reinforcement, test soil materials and verify pier depth. The Geotechnical engineer will also inspect shafts prior to concrete placement.
 - 4. If the Geotechnical Engineer's inspection determines that there is loose material in the shaft excavation, the Contractor will clean the hole as directed by the Geotechnical Engineer, including the removal of the reinforcing cage as required.
 - 5. The Owner's Testing Agency will inspect installation of reinforcing and placement of concrete in drilled piers.
 - 6. Materials and installed work may require testing and retesting at any time during the progress of work. Allow free access to material stockpiles and facilities.

1.06 PROJECT CONDITIONS

- A. Subsurface Information: Refer to Geotechnical Report.
- B. Existing Utilities: Locate existing underground utilities by careful hand excavation before starting shaft excavation operations.
 - 1. If utilities are to remain in place, provide protection from damage during construction operations.
 - 2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Owner immediately for directions as to procedure.
 - 3. Cooperate with Owner and public and private utility companies in keeping their respective service and facilities in operation at all times.
 - 4. Repair damaged utilities to the satisfaction of the utility owner.
 - 5. Do not interrupt existing utility serving facilities occupied and used by Owner or others, except where permitted in writing by Owner's Representative and then only after acceptable temporary utility services have been provided.
- C. Environmental Requirements: Groundwater is expected to be encountered during drilling. See Geotechnical Report for expected depth.
 - 1. Appropriate measures provided in geotechnical report shall be implemented to stabilize the drilled hole.
- D. Barricade excavations as required in accordance with Division 1 Section "Temporary Facilities and Controls."

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete Reinforcement: See Division 3 Section "Concrete Reinforcement."
- B. Concrete Materials: See Division 3 Section "Cast-in-Place Concrete."
- C. Steel Pipe Casings: ASTM A 283, Grade C; or ASTM A 36, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.
- D. Slurry: Pulverized sodium bentonite, pulverized attapulgite, or polymers, mixed with water to form stable colloidal suspension; complying with ACI 336.1 for density, viscosity, sand content, and pH. Super Mud manufactured by PDS Company Inc. or approved equal. To be used in accordance with manufacturer's recommendations.
- E. Concrete Mix:
 - 1. Prepare design mixes according to ACI 211.1 and ACI 301 for each type and strength of concrete determined by either laboratory trial mix or field test databases. Mix designs shall be stamped and signed by a registered Civil or Structural engineer licensed in the state of California. Contractor shall bear all costs for concrete mix designs.
 - a. Use a qualified testing agency for preparing and reporting proposed mix designs for laboratory trial mix basis.
 - 2. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:
 - a. Compressive Strength (28 Days): 4,000 psi.
 - b. Minimum Slump: Capable of maintaining the following slump until completion of placement:
 - 1) 4 inches for dry, uncased, or permanent-cased drilling method.
 - 2) 6 inches for temporary-casing drilling method.
 - 3) 7 inches for slurry displacement method.
- F. Do not air entrain concrete for drilled piers.
- G. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.
- H. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- I. Concrete-mix design adjustments may be considered if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant. Resubmit and obtain approval of proposed changes to concrete-mix proportions

PART 3 - EXECUTION

3.01 DESIGN

- A. Construct pier reinforcement cage per contract documents and to allow for insertion of a tremie tube for concrete placement. Reinforcing cage shall be free of irregularities that could interfere with insertion and removal of the tremie.

3.02 EXAMINATION

- A. Examine site conditions prior to commencement of drilling shafts.
- B. Notify immediately the Owner's Representative in writing in the event of unsatisfactory site conditions, indicating the nature of extent of unsatisfactory conditions.
- C. Protect adjacent affected structures from damage.
- D. Notify the Owner's Representative at least two workdays prior to commencing work.

3.03 SHAFT EXCAVATION

- A. Excavate shaft for piers to lengths shown on the drawings. Pier holes shall be reamed with a bucket and auger prior to steel reinforcement cage installation.
 - 1. Excavate shafts only after adjacent holes within 3 pier diameters are filled with concrete and allowed to set for at least 24 hours.
 - 2. At the completion of drilling, the bottom of the pile holes shall be cleaned of all loose or disturbed materials.
 - 3. The piles shall be cast within 4 hours of completion of each drill hole.
 - 4. Before casting concrete, the drilled holes shall be observed, and suitable condition at the bottom of the holes shall be confirmed.
 - 5. A properly designed flat bottom cleaning bucket must be used to clean all drill hole bottoms.
 - 6. The polymer slurry be properly formulated and that a cleaning bucket be used within 30 minutes of casting concrete.
 - 7. The Geotechnical Engineer representative shall re-check the bottom for accumulation of sediment immediately before lowering the tremie, and the bottom shall be re-cleaned if 1½ inch or thicker sediments are accumulated at the bottom.
 - 8. Piles closer than 3 diameters to each other should be drilled and filled with concrete alternatively, and concrete should be permitted to set at least 8 hours before drilling an adjacent pile.
 - 9. Concrete shall be cast using a tremie method unless the hole is pumped dry and the procedure is allowed by the Structural Engineer.
 - 10. A minimum head of 5 feet of concrete shall be maintained throughout the concrete placement to prevent contamination of the concrete with soil inclusions and to push the drilling slurry out.
 - 11. The drilled holes shall be filled with concrete as soon as possible (within less than 7 hours of drilling), and shall not be left open overnight.
 - 12. See the geotechnical report for more information.

B. Temporary Shaft Protection:

1. Temporary shaft protection is the responsibility of the contractor.
2. Temporary casing and/or drilling polymer slurry shall be required for shaft stabilization for upper fill and alluvial material. Refer to geotechnical report for more information.
3. Temporary casings shall have sufficient thickness to withstand compressive and withdrawal stresses as required to maintain shaft walls without displacing.
4. The inside diameter of the casing used for shaft stabilization should be no bigger than 4 inches larger than the designated pile diameter.
5. The contractor shall submit the proposed polymer slurry mix for approval by the geotechnical engineer prior to the construction.
6. Remove and replace or repair casings which are damaged during installation and which could impair the strength or efficiency of the completed pier.
7. Remove all casings after placing concrete.
8. The drilling slurry shall be maintained at least six feet above the groundwater level in order to provide adequate support to soil on the walls of the drilled pier excavations.
9. Drilling slurry shall be mixed in external tanks with adequate agitation for the slurry to become uniformly mixed, self-suspending and free of lumps. The slurry shall be mixed in accordance with the manufacturer's recommendations. pH and marsh funnel viscosity testing of the slurry shall be performed before introducing slurry to the drilled hole.
10. During drilling and prior to concrete placement, slurry shall be sampled from the top and bottom of each pier excavation using a double ball bailer. The slurry samples shall be tested for pH, marsh funnel viscosity, sand content and specific weight to confirm that the slurry properties are within the range of the manufacturer's recommendations. Slurry mix testing shall be performed by individuals trained by the manufacturer's representative. Slurry may be recycled for use on subsequent piers.

C. Construction Tolerances:

1. Maximum permissible variation of location at top of pier: Not more than 1/24 of the shaft diameter or 3 inches, whichever is less.
2. Maximum shaft out-of-plumb: Not be more than 1.5 percent of length nor exceeding 12.5 percent of shaft diameter or 15 inches, whichever is less.
3. Concrete cut-off elevation: Plus 1 inch or minus 0 inch.
4. If above tolerances are exceeded, provide additional or corrective construction to compensate for excessive eccentricity.
5. Submit proposed corrective construction methods to Owner's Representative for review before proceeding.

D. Obstructions:

1. Use core barrels with drilling equipment, hand labor using air-powered tools or other safe methods to remove rock, boulders and obstructions.
2. Dispose of excavated material in accordance as required by the Specifications.

3.04 DEWATERING

- A. Comply with requirements of Division 1 Section "Temporary Facilities and Controls."

3.05 OVER EXCAVATION

- A. No payment will be made for extra length when shafts are excavated to a greater depth than required or authorized by the Owner's Geotechnical Engineer, due to overdrilling by the Contractor.
- B. Complete pier depth and fill extra depth with approved concrete if other conditions are satisfactory.

3.06 REINFORCING STEEL

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement. See Division 3 Section "Concrete Reinforcement."
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover to reinforcement. Use 4 approved spacers equally spaced around the cage. Longitudinal spacing shall not be more than 10-15 feet between spacers to be tied to the cage.
- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather and to ensure smooth movement of the tremie.
- G. Reinforcing cages must be placed in the same shift that concrete placement occurs. Cages will not be allowed to stay in the hole until the next work shift. Reaming shaft, inspection of shaft, placement of cage, final inspection of shaft and concrete placement should take place in continuous sequence of operations without interruption.

3.07 CONCRETE PLACEMENT

- A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's Geotechnical Engineer, Owner's independent testing and inspecting agency. Provide protection sheets extending at least 12 inches beyond the edges of excavation opening.
- B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
 - 1. Maximum free-fall of the concrete shall be 5'-0". Free-fall concrete shall not strike reinforcing cage.

2. Where concrete cannot be directed down shaft without striking reinforcing, place concrete with chutes, tremies, or pumps.
3. Concrete shall be properly consolidated. Vibrate minimum top 60 inches of concrete.
 - a. The contractor shall provide proper document and data to demonstrate the proposed method of construction will provide adequate consolidation of the concrete.
- C. Slurry Displacement Method: Place concrete in slurry-filled shafts by tremie methods or pumping. Control placement operations to ensure that tremie or pump pipe is embedded no fewer than 10 feet into concrete, and flow of concrete is continuous from bottom to top of drilled pier without segregating the mixed materials.
 1. Minimum tremie diameter shall be 8 inches.
 2. Minimum pump pipe diameter shall be 4 inches.
 3. Follow all recommendations and procedures of ACI 336.1
- D. Maintain sufficient pressure head of concrete to prevent reduction in diameter of shaft by earth pressure and to prevent extraneous material from mixing with fresh concrete.
- E. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
 1. Concrete head shall exceed the anticipated outside soil and water pressure above the bottom of the casing at all times during the withdrawal, and is the responsibility of the Contractor to determine the adequate concrete head.
- F. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.
- G. Interrupted placing operations of over 45 minutes shall not be permitted.
- H. Remove excess laitance and slurry contaminated concrete using vacuum truck or other approved means to cut off elevation and backfill hole to working grade with clean sand.
- I. Hot and Cold Weather Placement: Provide in accordance with provisions of Division 3 Section "Cast-in-Place Concrete."

3.08 FIELD QUALITY CONTROL

- A. Provide field quality control testing and inspection for concrete and reinforcing steel as specified in Division 3 Section "Concrete Reinforcement" and Section "Cast-in-Place Concrete."
- B. Notify Owner and Geotechnical Engineer at least 48 hours prior to time that excavations will be ready for inspection and tests.
- C. Provide facilities as required to assist inspection and testing of excavations and cooperate with inspecting and testing personnel to expedite work.
- D. Geotechnical Engineer:
 1. Inspect and report results.

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2. Conduct inspections and provide reports as soon as possible so as not to delay concrete placement for acceptable excavations.
 3. Inspect shaft borings prior to installation of reinforcement, test soil materials and confirm pier depth.
- E. Owner's Testing Agency:
1. Inspect placement of reinforcement per Division 3 Section "Concrete Reinforcement."
 2. Inspect placement of concrete per Division 3 Section "Cast-in-Place Concrete."
- F. Perform slurry testing and provide results to Owner in accordance with approved Pier Installation Plan.

END OF SECTION

SECTION 32 12 16
ASPHALTIC CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt paving overlay.
 - 3. Hot-mix asphalt patching.
 - 4. Asphalt surface treatments.
 - a. Seal coats.
 - b. Crack sealants.
 - 5. Pavement-marking paint.
- B. Related Sections:
 - 1. Section 312000 – Earth Moving.

1.3 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the standard specifications of the State or of authorities having jurisdiction.
 - 1. Standard Specification: CalTrans
 - 2. Manual of Tests: CalTrans
 - 3. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.4 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: For each job mix proposed for the Work. Provide certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - B. Material Certificates: For each paving material, signed by manufacturer certifying that each material complies with requirements.
 - C. Material Test Reports: For each paving material.
- 1.6 QUALITY ASSURANCE
- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of California Department of Transportation (CalTrans) for asphalt paving work.
 1. Comply with requirements of local jurisdictions where more stringent than CalTrans requirements.
 2. Measurement and payment provisions and safety program submittals included in CalTrans standard specifications do not apply to this Section.
 - B. Regulatory Requirements: Comply to applicable standards of the San Diego County Air Pollution Control District for quantities of volatile organic compounds (VOC) used in all materials.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
 - B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.
- 1.8 PROJECT CONDITIONS
- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 1. Tack Coat: Minimum surface temperature of 60 deg F.
 2. Seal Coat: Comply with weather limitations of ASTM D 3910
 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
 - B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

1. 40 deg F for oil-based materials.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Base Coarse Aggregate: Class 2 Aggregate Base mineral aggregate, 3/4 inch maximum size, as specified in CalTrans Standard Specifications.
 1. Recycled asphalt paving may be used as base course aggregate, subject to complying with CalTrans Standard Specifications.
- C. Asphalt Aggregate: Type B Aggregate, as specified in CalTrans Standard Specifications.
 1. 3/4 inch maximum size for base course.
 2. 1/2 inch maximum size for surface course.

2.2 ASPHALT MATERIALS

- A. Asphalt Cement: Steam Refined, penetration-graded material. PG64-10 conforming to CalTrans Standard Specifications.
- B. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- C. Seal Coat: Emulsified asphalt with a minimum 2% - 3% latex or copolymer added with 2-4 lbs of grade #30 silica sand added per gallon and mechanically agitated.
- D. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the Environmental Protection Agency (EPA). Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.
- C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- D. Crack Sealer: Rubberized joint sealant complying with Federal Standards ASTM D5329 Parking Lot Crack Sealer.

- E. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II.

- 1. Color: As indicated.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:

- 1. Comply with CalTrans Standard Specifications.
 - 2. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure that any air handling system that is likely to ingest fumes is protected and that windows near paving operations are closed.
- B. Verify that subgrade is dry and in suitable condition to begin paving.
- C. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Notify Architect in writing of any unsatisfactory conditions. Proceed with paving only after unsatisfactory conditions have been corrected.
- E. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Repair or replace curbs, manholes, and other construction damaged

- during cold milling.
2. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
3. Keep milled pavement surface free of loose material and dust.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions, and in compliance with the District Pest Control specifications where more stringent. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 2. Protect primed substrate from damage until ready to receive paving.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 PAVING GEOTEXTILE INSTALLATION

- A. Apply asphalt binder/cement, consisting of solvent-free emulsified asphalt, uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.
 1. Protect paving geotextile from traffic and other damage and place hot-mix asphalt paving overlay the same day.

3.5 BASE COURSE

- A. Install paving geotextile on prepared subgrade or subbase according to manufacturer's written instructions, overlapping sides and ends.
- B. Place base course on separation fabric according to manufacturer's written instructions and as follows:
 - 1. Compact base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
 - 2. Shape base to required crown elevations and cross-slope grades.
 - 3. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
 - 4. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches or less than 3 inches thick when compacted.

3.6 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. When thickness of asphalt course is 4 inches or less, place materials in a single layer.
 - 2. When thickness of asphalt course exceeds 4 inches, place material in equal layers, with no layer more than 4 inches or less than 2 inches thick when compacted.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving

sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Use a vibratory roller with dynamic force of 93,000 lbs, or weighing 21,000 lbs. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density, using one of the following methods as acceptable to the authority having jurisdiction:
 1. Average Density (Hveem Test Method): 96 percent of reference laboratory density according to ASTM D 1561, but not less than 95 percent nor greater than 100 percent.
 2. Average Density (Rice Test Method): 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact

thoroughly.

- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 ASPHALT SPEED BUMPS

- A. Construct asphalt speed bumps over compacted pavement. Apply a light tack coat to compacted pavement unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F.
 - 1. Asphalt Mix: Same as pavement surface-course mix.
- B. Place hot-mix asphalt to speed bump cross section as indicated.

3.10 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.11 CRACK REPAIR

- A. Remove vegetation and treat with herbicide.
- B. Rout cracks in accordance with SHARP H348 and H349.
- C. Fill cracks with hot-applied joint sealant. Apply with a wand from a double jacketed melter.
 - 1. Over-fill cracks and squeegee level with pavement.

3.12 SURFACE TREATMENTS

- A. Seal Coat: Apply first coat at rate of 0.125 to 0.185 gal./sq. yd. After first coat has dried, apply second coat at rate of 0.100 to 0.185 gal./sq. yd.
 - 1. Seal coating new pavements should be delayed 6-12 months after installation or as recommended by manufacturer.
 - 2. Preparation: All area shall be power-swept, vacuumed and cleared of loose material.
 - 3. Standing water shall be spread out and allowed to dry. Do not apply seal coat to wet or damp surfaces.
 - 4. Oil spots shall be manually scraped and cleaned with a mild detergent. Apply primer over highly saturated petroleum areas.
 - 5. Cover and protect items within paved area that are not to be coated, such as valve boxes, manholes and concrete.
- B. Fog Seals: Apply fog seal at manufacturer's recommended rate, but not less than 0.30 gal./sq. yd. to existing asphalt pavement and allow to cure. Apply in multiple coats. With fine sand, lightly dust areas receiving excess fog seal.
 - 1. Fog coating new pavements should be delayed 12 months after installation or as recommended by manufacturer unless pavement is showing severe raveling.
 - 2. On extremely rough surfaces, provide sand fill for base application where recommended by manufacturer.

3.13 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 30 days before starting pavement marking, unless otherwise acceptable to the paint manufacturer.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: District will engage a qualified independent testing agency to perform field tests and inspections and to prepare test reports.
- B. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.15 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

- 1. Do not allow milled materials to accumulate on-site.

END OF SECTION 32 12 16

SECTION 32 13 13
CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.
 - 5. Unit paver base.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.
 - 2. Division 2 Section "Pavement Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.2 REFERENCED STANDARDS

- A. The editions and specifications and standards referenced herein, published by the following organizations apply to the construction only to the extent specified by the reference.
 - 1. Standard Specifications:
 - a. Standard Specifications for Public Works Construction (current edition).
 - b. Standard special provisions of the Regional Standards Committee.
 - c. City of San Diego Standard Special Provisions, Document No. 769709 (current date).
 - d. California Department of Transportation, "Manual of Traffic Controls, for Construction and Maintenance Work Zones," (current edition), Document No. 869159 (current date).
 - e. Standard Drawings: City of San Diego Standard Drawings, Document No. 769710 (current date).

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's product data with application and installation instructions for proprietary materials and items such as admixtures, curing materials, and joint systems.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Quality Control: Tests of concrete shall be made by a Testing Laboratory approved by the University's Representative. The cost of sampling and testing required by these specifications shall be borne by the University, except that any retesting of nonconforming material shall be paid for by the Contractor. Concrete shall have a compressive strength of 3,250 psi, unless otherwise noted, at the end of 28 days unless otherwise noted.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or epoxy adhesive.
 - 8. Joint fillers.
- F. Field quality-control test reports.
- G. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
 - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by University's Representative.
 - 2. Notify University's Representative seven days in advance of dates and times when mockups will be constructed.
 - 3. Obtain University's Representative's approval of mockups before starting construction.
 - 4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
 - 5. Demolish and remove approved mockups from the site when directed by University's Representative.
 - 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings" and Quality Control."
 - 1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete producer.
 - d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- B. Plain Steel Wire: ASTM A 82, as drawn.
- C. Deformed-Steel Wire: ASTM A 496.
- D. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- E. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- F. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

H. Zinc Repair Material: ASTM A 780.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Concrete shall be 520-A-2500 per Section 201-1 of the Standard Specifications, unless otherwise noted.
2. Concrete for curbs and gutters shall be Class 560-C-325p0 per Section 201-1 of the Standard Specifications.
3. Concrete for cross gutters shall be Class 560-C-3250 per Section 201-1 of the Standard Specification.
4. Portland Cement: ASTM C 150, Type I or II. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Products:

- a. Axim Concrete Technologies; Cimfilm.
- b. Burke by Edeco; BurkeFilm.
- c. ChemMasters; Spray-Film.
- d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
- e. Dayton Superior Corporation; Sure Film.
- f. Euclid Chemical Company (The); Eucobar.
- g. Kaufman Products, Inc.; Vapor Aid.
- h. Lambert Corporation; Lambco Skin.
- i. L&M Construction Chemicals, Inc.; E-Con.
- j. MBT Protection and Repair, ChemRex Inc.; Confilm.
- k. Meadows, W. R., Inc.; Sealtight Evapre.
- l. Metalcrete Industries; Waterhold.
- m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
- n. Sika Corporation, Inc.; SikaFilm.
- o. Symons Corporation; Finishing Aid.
- p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- q. Or Equal.

- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
- b. Burke by Edoko; Aqua Resin Cure.
- c. ChemMasters; Safe-Cure Clear.
- d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
- f. Euclid Chemical Company (The); Kurez DR VOX.
- g. Kaufman Products, Inc.; Thinfilm 420.
- h. Lambert Corporation; Aqua Kure-Clear.
- i. L&M Construction Chemicals, Inc.; L&M Cure R.
- j. Meadows, W. R., Inc.; 1100 Clear.
- k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
- l. Symons Corporation; Resi-Chem Clear.
- m. Tamms Industries Inc.; Horncure WB 30.

- n. Unitex; Hydro Cure 309.
 - o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
 - p. Or Equal.
- F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.
 - 1. Products:
 - a. Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
 - b. Burke by Edoco; Resin Emulsion White.
 - c. ChemMasters; Safe-Cure 2000.
 - d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
 - f. Euclid Chemical Company (The); Kurez VOX White Pigmented.
 - g. Kaufman Products, Inc.; Thinfilm 450.
 - h. Lambert Corporation; Aqua Kure-White.
 - i. L&M Construction Chemicals, Inc.; L&M Cure R-2.
 - j. Meadows, W. R., Inc.; 1200-White.
 - k. Symons Corporation; Resi-Chem White.
 - l. Tamms Industries, Inc.; Horncure 200-W.
 - m. Unitex; Hydro White.
 - n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.
 - o. Or equal.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber] [or] [ASTM D 1752, cork or self-expanding cork.
 - 1. Use a preformed asphalt-impregnated expansion joint filler 1/4 inch thick for curbs and sidewalks conforming to Section 201-3.2 of the Standard Specifications.
- B. Expansion Joint Sealer:
 - 1. Expansion joint sealer shall be a two part polysulfide sealant conforming to Federal Specification TT-S-00227, Class A, self-leveling, colored to match the concrete.
- C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.7 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-P-115, Type [I] [II] or AASHTO M 248, Type N.
 - 1. Color: As indicated.
- B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 3 minutes.
 - 1. Color: As indicated.
- C. Glass Beads: AASHTO M 247, Type 1.

2.8 FIRE HYDRANT MARKERS

- A. Double-faced blue reflective pavement markers with optical grade methyl methacrylate lenses, or equal.
 - 1. Dimensions: 4 inches by 4 inches by 3/4-inch high.

2.9 WHEEL STOPS

- A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.10 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days) as noted.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.

- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
 - 1. Preparation of subgrade: The subgrade shall be prepared per Section 301-1 of the Standard Specification.
- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.

2. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 2 Section "Earthwork."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
 - 2. Provide tie bars at sides of pavement strips where indicated.
 - 3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
 - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Expansion joints shall be located at 45' intervals and as required by Standard Drawing G-9. Joints shall be constructed per Standard Drawing G-10 and per Section 303-5 of the Standard Specifications.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat

- grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
- F. Portland Cement Concrete paving and concrete finish shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Sidewalk: Construct sidewalk per Section 303-5 of the Standard Specifications.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.
- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 - 1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by University's Representative.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Curbs and Gutters:
 - 1. Excavate and shape subgrade for curbs and gutters, to line, grade and cross section. Compact subgrade until the top 12 inches are compacted to 90% relative compaction. Remove all soft material disclosed by compacting and replace with crushed rock base. The finished subgrade shall be within a tolerance of ± 0.08 of a foot of the grade and cross section shown and shall be smooth and free from irregularities at the specified relative compaction.
 - 2. Set forms in accordance with Section 303-5.2 of the Standard Specifications. Tops of forms shall not depart from gradeline more than 1/8 inch when checked with a 10-foot straightedge. Alignment of straight sections shall not vary more than 1/8 inch in 10 feet.
 - 3. Construct curb and gutters to line and grade shown per Section 303-5 of the Standard Specifications. Curb and gutters shall conform to the details shown on the Drawings and Standard Drawing as called out on the plans.
 - 4. Place performed asphalt-impregnated expansion joints and weakened plane joints as shown in Standard Drawing G-9 and G-16. Joints shall conform with Standard Specification Section 303-5.
 - 5. Finished curb shall present a uniform appearance for both grade and alignment. Remove any section of curb showing abrupt changes in alignment or grade or which is more than 1/4 inch away from the position required by the plans and construct new curb in its place at no additional cost to the University.
- M. Curbs and Gutters Machine Placement:
 - 1. When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- N. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- O. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- P. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage.
1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- Q. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 SPECIAL FINISHES

- A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in pavement surfaces as follows:
 - 1. Immediately after float finishing, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
 - 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 - 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
 - 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on pavement surface. Tamp aggregate into plastic concrete, and float finish to entirely embed aggregate with mortar cover of 1/16 inch.
 - 1. Spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
 - 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
 - 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
 - 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions and as follows:
 - 1. Uniformly spread 25 lb/100 sq. ft dampened slip-resistive aggregate over pavement surface in 2 applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
 - 2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over pavement surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
 - 3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
 - 4. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

3.9 CONCRETE PROTECTION AND CURING

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

- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 PAVEMENT TOLERANCES

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

3.11 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with University's Representative.
- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal..

3.12 FIRE HYDRANT MARKER INSTALLATION

- A. Install markers to identify each new or relocated fire hydrant. Locate marker approximately 12 inches from the center stripe of a striped road, or 18 inches from the centerline of the travel lanes on a road without center striping, towards the side where the fire hydrant is located.
- B. Affix marker to pavement using epoxy adhesive specifically intended for such use.

3.13 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to University's Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by University's Representative but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by University's Representative.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 3.15 REPAIRS AND PROTECTION
- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

- B. Drill test cores, where directed by University's Representative, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

3.16 CLEAN UP

- A. Do not allow any concrete spill or waste on planting area.
- B. Guard against graffiti; guarding shall be 24 hours a day if necessary. All marked, defective or defaced material shall be replaced by removing the entire section between construction joints.
- C. Remove all concrete debris and spill from all planting areas, leaving the area clean and free of all noxious materials.

END OF SECTION 32 13 13

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Pedestrian and related accessibility pavement markings
- B. Related Sections
 - 1. Section 01 35 42, CALGreen Requirements

1.02 REFERENCE STANDARDS

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ADA - Americans with Disabilities Act of 1990, as amended
 - 1. ADA Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design
- C. APCD - Air Pollution Control District of San Diego County
 - 1. APCD-67.0 - APCD Regulation IV, Rule 67.0, Architectural Coatings
 - 2. APCD-67.21 - APCD Regulation IV, Rule 67.21, Adhesive Material Application Operations
- D. ASTM - American Society for Testing and Materials
 - 1. ASTM C 881 - Epoxy-Resin-Base Bonding Systems for Concrete
 - 2. ASTM D 788 - Classification System for Poly(Methyl Methacrylate) (PMMA) Molding and Extrusion Compounds
- E. CALTrans - California Department of Transportation
 - 1. CALTrans Manual - CALTrans, Manual for Uniform Traffic Control Devices
 - 2. CALTrans Specifications - CALTrans, Standard Specifications
- F. CBC - 2016 California Building Code (CCR Title 24, Part 2)
 - 1. CBC-11B - CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing
- G. California Green Building Standards Code, CALGreen - 2016.
- H. Fed.Std / Fed.Spec - Federal Standard / Federal Specification
 - 1. Fed.Std-595C - Colors Listed in Government Procurement
 - 2. Fed.Spec TT-P-1952D - Paint, Traffic and Airfield Marking, Waterborne
- I. SCAQMD - South Coast Air Quality Management District
 - 1. SCAQMD-1113 - SCAQMD Rule 1113, Architectural Coatings
 - 2. SCAQMD-1168 - SCAQMD Rule 1168, Adhesive and Sealant Applications

- J. SSPWC - Standard Specifications for Public Works Construction (California)

1.03 SUBMITTALS

- A. Action Submittal
 - 1. Product Data for each paint system product and accessory item
 - 2. Shop Drawings of traffic and parking markings
- B. Record Submittals
 - 1. Manufacturer's Application Instructions
- C. CALGreen Submittals:
 - 1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.04.C.

1.04 QUALITY ASSURANCE

- A. Paints and Coatings: VOC content within limits set by SCAQMD-1113 .
- B. Adhesives and Sealants shall have VOC content within limits required by SCAQMD-1168.
- C. California Green Building Standards Code, CALGreen - 2016.
 - 1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
 - 2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.
- D. Regulatory Requirements
 - 1. Pavement markings for designated accessible parking spaces and related pedestrian stripping shall conform to ADA Standards or CBC-11B whichever provides persons with disabilities greater protection.
 - 2. Traffic control pavement and curb markings shall be in accordance with SSPWC, Sections 210-1.6 and 310-5.6.
 - 3. Paint products shall dry to a finish as slip resistant as surrounding pavement.
 - 4. Detectable warning textures shall be as specified in Section 32 13 13.
- E. Manufacturer: company with minimum 10-years' experience manufacturing traffic line paint products for commercial projects similar in scale, complexity and quality to those required for this Project.
- F. Installer: company with minimum 6-years' experience painting traffic and related pavement markings for commercial projects similar in scale, complexity and quality to those required for this Project.
- G. Field Samples
 - 1. Provide field sample, illustrating coating color, width of stroke, thickness of application and dimensioning.
 - 2. Location: acceptable to Architect.

3. Modify materials and methods of installation as required to obtain Architect's approval.
4. Document materials and methods used to obtain Architect's approval. Maintain at least one copy of this documentation in a readily accessible location on Site while this work is in progress.
5. Maintain access to and protect Field Sample from damage while this work is in progress.
6. Upon acceptance of related work, Field Sample in acceptable condition may remain as part of the work.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in manufacturer's original, sealed containers with labels legible and intact.
 1. Labels shall include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.
- B. Store paint materials at ambient temperatures between 45- and 90-degrees-F, unless expressly permitted otherwise in manufacturer's printed instructions.

1.06 MAINTENANCE

- A. For each color of pavement marking paint furnish, as Extra Material, a five-gallon unopened container of the paint.
 1. Extra Materials shall be from same production run as installed materials.
 2. In addition to manufacturer's label, label each container for color, dates and locations of related installations and shelf life.
 3. Deliver Extra Materials to Owner as directed.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Accessible Parking:
 1. Accessible parking spaces shall be located as near as practical to a primary entrance and shall be marked according to CBC Section 11B-208.3.1
 2. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance complying with CBC Section 11B-208.3.1.
 3. Accessible parking spaces serving more than one accessible entrance shall be dispersed and located on the shortest accessible route to the accessible entrances.
 4. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. CBC Section 11B-208.3.1.
 5. Minimum number of required accessible parking spaces shall be provided in accordance with CBC Table 11B-208.2 for each parking facility provided on a site.
 6. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. CBC Section 11B-208.2.4.

7. Accessible parking spaces and access aisles shall comply with CBC Section 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:
 - a. Parking spaces and access aisles shall be marked according to CBC Figures 11B-502.2, 11B-502.3, and 11B-502.3.3. Their surfaces shall comply with 1:48 in any direction. CBC Section 11B-502.4.
 - b. Parking spaces shall be 9' x 18' minimum and van parking spaces shall be 12' x 18' minimum with an adjacent access aisle of 5' x 18' minimum. Access aisles shall be placed on either side of the parking spaces except be located on the passenger side for van parking spaces. Van parking spaces shall be permitted to be 9' x 18' minimum where the access aisle is 8' x 18' minimum
 - c. Access aisles shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CBC Section 11B-502.3.
 - d. Access aisles (accessible parking spaces as well - similar application) shall not overlap the vehicular way. CBC Section 11B-502.3.4.
 - e. A vertical clearance of 8' - 2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. CBC Section 11B-502.5.
- B. Passenger Drop-Off and Loading Zones:
 1. At least one passenger loading zone shall be provided in every continuous 100 linear feet of loading zone space, or fraction thereof, complying with CBC Sections 11B-209 and 11B-503 as follows:
 - a. Vehicle pull-up spaces shall be 8' x 20' minimum
 - b. Access aisles shall be 5' wide minimum x full length of vehicle pull-up spaces they serve and shall be adjacent and parallel to the vehicle pull-up spaces. They shall be at the same level with each other and with slopes not steeper than 1:48 in any direction. Access aisle shall adjoin accessible route and shall not overlap the vehicular way.
 - c. Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with a painted hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface. (Blue interior hatch lines are preferred for concrete surfaces and white interior hatch lines are preferred for asphalt surfaces. Where white hatch lines are used, hatch lines shall be interrupted at 12" high "No parking" text so that legibility is maintained) CBC Section 11B-503.3.3.
 - d. A vertical clearance of 9'-6" minimum shall be provided for vehicle pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and vehicular exit. CBC Section 11B-503.5
- C. Bus Loading Zone:
 1. Bus loading zones and bus stops shall comply with CBC Sections 11B-209 and 11B-810.2 as follows:

- a. Bus boarding and alighting areas shall be of 8' x 5' minimum, with 8' measured perpendicular to the curb or vehicle roadway edge, and with 5' measured parallel to the vehicle roadway. Slopes in 8' direction shall be 1:48 maximum. Slopes in 5' direction shall be the same as that of the roadway, to the maximum extent practicable. CBC Figure 11B-810.2.2.
 - b. Bus shelters shall provide a minimum 30" x 48" clear floor or ground space (36" x 48" or 36" x 60" in an alcove per CBC Section 11B-305.7), with slopes not steeper than 1:48 in any direction, entirely within the shelter complying with CBC Section 11B-305.
 - c. Bus shelters shall be connected by an accessible route complying with CBC Section 11B-402 to a boarding and alighting area complying with CBC Section 11B-810.2 and Figure 11B-810.3.
 - d. New Constructed bus stop boarding and alighting areas shall provide a detectable transition between the boarding/alighting area and the roadway; the detectable transition shall consist of a curb with the face sloped at 35 degrees maximum from vertical or detectable warnings complying with CBC Sections 11B-705.1.1 and 11B-705.1.2.4.
2. Electrical Vehicle Charging Stations:
- a. Where Electric Vehicle Charging Stations are provided, they shall be provided in accordance with CBC Section 11B-228.3, Table 11B-228.3.2.1 and CBC Section 11B-812.
 - b. Accessibility requirements for Public Use or Common use EVCS Facilities:
 - 1) Vehicle spaces and access aisles serving them shall comply with CBC Section 11B-302. Access aisles shall be at the same level as the vehicle space they serve. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted in vehicle spaces and access aisles. CBC Section 11B-812.3
 - 2) Vehicle spaces, access aisles serving them and vehicular routes serving them shall provide a vertical clearance of 98-inches minimum. CBC Section 11B-812.4.
 - 3) Accessible routes between EVCS parking, equipment and the building or facility served shall be provided per CBC Section 11B-812.5.
 - 4) Vehicle spaces for van accessible, standard accessible, ambulatory and drive-up EVCS shall meet minimum length and width requirements per CBC Section 11B-812.6. All EVCS stalls shall be marked EV Charging Only per CBC Section 11B-812.9 and Figure 11B-812.9.
 - 5) Access aisles for van accessible and standard accessible EVCS shall meet minimum length and width requirements and be marked per CBC Section 11B-812.7 the color of the perimeter, hatch lines and "No Parking" letters shall contrast with the surface color (blue color required for use at non-EVCS accessible parking shall not be used).

- 6) Where four or fewer total EVCS are provided, identification with an International Symbol of Accessibility (ISA) shall not be required. When five to twenty-five total EVCS are provided, one van accessible EVCS shall be identified with an ISA complying with CBC Section 11B-703.7.2.1. The required standard accessible EVCS shall not be required to be marked with an ISA. Where twenty-six or more EVCS are provided, all required van-accessible and all required standard accessible EVCS shall be identified with an ISA. The required ISA identification sign shall be reflective with a minimum of 70 square inches, shall be visible from the EVCS it serves. The sign shall be permanently posted either immediately adjacent to the vehicle space or within the project vehicle space at the head end of the vehicle space. Signs identifying van accessible vehicle spaces shall contain the designation "Van Accessible". Signs shall be minimum 60" above the finish surface except that if the signs project into a pedestrian circulation area, they shall be minimum 80" above the finish. CBC Section 11B-812.8.
 - 7) Ambulatory EVCS complying with CBC Section 11B-812.6.3 shall be required where 26 or more EVCS are provided. CBC Table 11B-228.3.2.1.
- D. Surface slopes of accessible parking spaces and access aisles shall be the minimum possible and shall not exceed 2% slope in any direction. CBC Section 11B-502.4
 - E. ISA Markings: Each accessible car and van space shall have surface identification complying with 11B-502.6.4.
 - F. When blue color is used, it shall conform to Color No. 15090 per Federal Standard 595C.
 - G. Painted lines and markings on pavement are recommended to be 3" wide minimum.

2.02 PAVEMENT MARKING PAINTS

- A. Acceptable Manufacturers. Products of following manufacturers form basis of design and quality intended for this Project.
 - 1. Dunn-Edwards Corporation, Los Angeles, CA
 - 2. Glidden Professional, Commerce, CA
 - 3. Frazee Paint and Wallcovering, Inc., Anaheim, CA
 - 4. Or equal, approved in accordance with Division 01 requirements for substitutions.
- B. Traffic Line Paint: lead and chromate free, ready mixed, waterborne emulsion type, complying with Fed.Spec TT-P-1952D with drying time of less than 45 minutes. Furnish paints in containers of at least 18 L (5 gallons).
 - 1. Colors
 - a. Other Parking Stall Lines and Traffic Control markings: white.
 - 2. Acceptable Products
 - a. Dunn-Edwards, Vin-L-Stripe Traffic Paint, Vinyl Epoxy Emulsion, W801
 - b. Glidden Pro, Traffic Paint 4810, Fast Dry Acrylic
 - c. Frazee, No. 506 Traffic Line Paint
 - d. Or equal

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive Work as instructed by product manufacturer.
- B. Do not begin installation until unsatisfactory conditions are corrected. Beginning installation means acceptance of existing conditions including the preparatory work of others, if any.

3.02 PREPARATION

- A. Clean pavement in immediate vicinity of markings as directed by paint manufacturer.
 - 1. Surfaces to be painted shall be clean and free of dust, dirt, grease, oil, water or other contaminants.
 - 2. Existing lines to be removed shall be sandblasted clean.
- B. Do not apply traffic paint to AC paving until seal coat has been in place minimum of 10 days.

3.03 APPLICATION

- A. Apply paints by machine spray, airless sprayer, roller or brush to provide a minimum DFT of 15 mils. Precise edges are required; no overspray will be accepted.
 - 1. Stripping: single, 4 inch wide lines, unless double lines are shown on drawings.
- B. Perform Work in accordance with approved Shop Drawings and with SSPWC Section 310-5.6.8.
 - 1. Striping, pavement markings, and curb markings shall be in accordance with SSPWC Sections 210-1.6 and 310-5.6 or accessibility requirements, as applicable.

3.04 DEFECTIVE WORK

- A. Remove any paint that demonstrates evidence of checking, cracking, peeling, discoloration, lack of bonding or poor coverage. Misplaced lines shall be completely removed by paint remover or wet abrasive-blasting in accordance with SSPWC, Section 310.5.6.3. Painting over misplaced lines will not be permitted. Provide new complying work without claim for change in Contract Sum or Schedule.

END OF SECTION

SECTION 32 17 27

CAST-IN-PLACE TACTILE/DETECTABLE WARNING TILE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place tactile tile modules where indicated.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Samples for Verification Purposes: Submit two tile samples minimum 6" by 8" of kind proposed for use.
- C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.
- D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on Surface Applied tactile tile system as certified by a qualified independent testing laboratory.
- E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

1.03 QUALITY ASSURANCE

- A. Provide Surface Applied tactile tiles and accessories as produced by a single manufacturer.
- B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces that comply with detectable warnings on walking surfaces section of Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES).

- D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR). Title 24, Part 1, Articles 2, 3 and 4 and Part 2, Section 205 definition of "Detectable Warning". Section 11B-705.1.2.2 for "Curb Ramps" and Section 11B-705.1.2.5 for Hazardous Vehicle Areas".
- E. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1.
 - 1. Detectable warning surfaces at transit boarding platform edges, bus stops, hazardous vehicular areas, reflecting pools and track crossing shall be yellow and approximate AMS Standard 595A Color No. 33538. Detectable warning surfaces shall be color of AMS Standard 595A Color No. 33538 or a color providing a 70% minimum visual contrast with that of adjacent walking surfaces. The material used to provide visual contrast shall be an integral part of the surface. CBC Section 11B-705.1.1.3
 - 2. Detectable warning surfaces shall differ from adjoining surfaces in resiliency and or sound-on-cane contact. Such constraint shall not be required for detectable warning surfaces at curb ramps, islands, or cut-through medians. CBC Section 11B-705.1.1.4.
 - 3. Truncated Domes: provide raised Detectable Warnings with diameter of 0.90" min. to 0.92" max. at base tapering to 0.45" min. to 0.47" max. at top, height of 0.20" and base-to-to base spacing of 0.65" min. measured between the most adjacent domes on a square grid (in-line pattern).
 - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.
- B. Tiles shall be delivered to location at building site for storage prior to installation.

1.05 SITE CONDITIONS

- A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40°F in areas where work is completed.
- B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.
- C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.

- D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

1.06 EXTRA STOCK

- A. Deliver extra stock to storage area designated by engineer. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for Surface Applied tactile tiles. Furnish not less than two (2) percent of the supplied materials for each type, color and pattern installed.

1.07 WARRANTY (DETECTABLE WARNINGS AND DIRECTIONAL TEXTURE)

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detectable warnings and directional surface products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.
 - b. Degrade significantly means that product maintains at least 90 percent of its approved design characteristics, as determined by the authority having jurisdiction.
 - 2. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Engineered Plastics Inc, Armor Tile.
 - 2. ADA Solutions, Inc., North Billerica, MA.
- B. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705 and the California Accessibility Reference Manual.
- C. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.
 - 1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.90" min. to 0.92" max. at base tapering to 0.45" min. to 0.47" max. at top, height of 0.20" and base-to-to base spacing of 0.65" min. measured between the most adjacent domes on a square grid (in-line pattern).
 - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.

2. Cast-In-Place Detectable Warning Texture (Truncated Domes):
Plastics/Composites: Armor Tile, ADA Tactile Systems by Engineered Plastics Inc., or equal.
- D. The Vitrified Polymer Composite (VPC) Cast-in-Place Tactile Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
- E. Color: Yellow conforming to AMS Standard 595A Color No. 33538. Color shall be homogeneous throughout the tile.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. During all cast-in-place detectable/tactile warning surface tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- B. The specifications of the structural embedment flange system and related materials shall be in strict accordance with the manufacturer's instructions.
- C. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Architect.
- D. The physical characteristics of the concrete shall be consistent with the contract specifications while maintaining a slump range of 4 - 7 to permit solid placement of the Cast In Place Detectable/Tactile Warning Surface Tile system. An overly wet mix will cause the tile to float. Under these conditions, suitable weights such as 2 concrete blocks or sandbags (25 lb) shall be placed on each tile.
- E. The concrete pouring and finishing operations require typical mason's tools, however, a 4' long level with electronic slope readout, 25 lb. weights, and a large non-marring rubber mallet are specific to the installation of the Cast In Place Detectable/Tactile Warning Surface Tile system. A vibrating mechanism such as that manufactured by Vibco can be employed, if desired. The vibrating unit should be fixed to a soft base such as wood, at least 1 foot square.
- F. The factory-installed plastic sheeting must remain in place during the entire installation process to prevent the splashing of concrete onto the finished surface of the tile.
- G. When preparing to set the tile, it is important that no concrete be removed in the area to accept the tile. It is imperative that the installation technique eliminates any air voids under the tile. Holes in the tile perimeter allow air to escape during the installation process. Concrete will flow through the large holes in each embedment flange on the underside of the tile. This will lock the tile solidly into the cured concrete.

- H. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. Immediately after finishing concrete, the electronic level should be used to check that the required slope is achieved. The tile shall be placed true and square to the curb edge in accordance with the contract drawings. The Cast In Place Detectable/Tactile Warning Surface Tiles shall be tapped (or vibrated) into the fresh concrete to ensure that the field level of the tile is flush to the adjacent concrete surface. The embedment process should not be accomplished by stepping on the tile as this may cause uneven setting which can result in air voids under the tile surface. The contract drawings indicate that the tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
- I. In cold weather climates it is recommended that the Cast In Place Detectable/Tactile Warning Surface Tiles be set deeper such that the top of domes are level to the adjacent concrete on the top and sides of ramp and that the base of domes to allow water drainage. This installation will reduce the possibility of damage due to snow clearing operations.
- J. Immediately after placement, the tile elevation is to be checked to adjacent concrete. The elevation and slope should be set consistent with contract drawings to permit water drainage to curb as the design dictates. Ensure that the field surface of the tile is flush with the surrounding concrete and back of curb so that no ponding is possible on the tile at the back side of curb.
- K. While concrete is workable, a 3/8" radius edging tool shall be used to create a finished edge of concrete, then a steel trowel shall be used to finish the concrete around the tile's perimeter, flush to the field level of the tile.
- L. During and after the tile installation and the concrete curing stage, it is imperative that there is no walking, leaning or external forces placed on the tile that may rock the tile causing a void between the underside of tile and concrete.
- M. Following tile placement, review installation tolerances to contract drawings and adjust tile before the concrete sets. Two suitable weights of 25 lb each may be required to be placed on each tile as necessary to ensure solid contact of the underside of tile to concrete.
- N. Following the concrete curing stage, protective plastic wrap is to be removed from the tile surface by cutting the plastic with a sharp knife, tight to the concrete/tile interface. If concrete bled under the plastic, a soft brass wire brush will clean the residue without damage to the tile surface.
- O. If desired, individual tiles can be bolted together using ¼ inch or equivalent hardware. This can help to ensure that adjacent tiles are flush to each other during the installation process. Tape or caulking can be placed on the underside of the bolted butt joint to ensure that concrete does not rise up between the tiles during installation. Any protective plastic wrap which was peeled back to facilitate bolting or cutting, should be replaced and taped to ensure that the tile surface remains free of concrete during the installation process.

- P. Tiles can be cut to custom sizes, or to make a radius, using a continuous rim diamond blade in a circular saw or mini-grinder. Use of a straightedge to guide the cut is advisable where appropriate.
- Q. Any sound-amplifying plates on the underside of the tile, which are dislodged during handling or cutting, should be replaced and secured with construction adhesive. The air gap created between these plates and the bottom of the tile is important in preserving the sound on cane audible properties of the Armor-Tile system as required in various jurisdictions.

3.02 CLEANING AND PROTECTING

- A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.
- B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.
- C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by methods recommended by manufacturer.

END OF SECTION

SECTION 33 41 00
STORM DRAIN SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, non-pressure storm drainage outside the building, with the following components:
 - 1. Special fittings for expansion and deflection.
 - 2. Backwater valves.
 - 3. Cleanouts.
 - 4. Drains.
 - 5. Corrosion-protection piping encasement.
 - 6. Precast concrete manholes.

1.2 REFERENCED STANDARDS

- A. The editions and specifications and standards referenced herein, published by the following organizations apply to the construction only to the extent specified by the reference.
- B. Standard Specifications:
 - 1. Standard Specifications for Public Works Construction, (Current Edition).
 - 2. Standard Special Provisions of the Regional Standards Committee.
 - 3. City of San Diego Standard Special Provisions, Document No. 769345, filed current date.
 - 4. California Department of Transportation, "Manual of Traffic Controls, for Construction and Maintenance Work Zones", (Current Edition), Document No. 869159, filed current date.
- C. Standard Drawings:
 - 1. City of San Diego Standard Drawings, Document No. 769374, filed June 3, 1986.
 - 2. American Water Works Association (AWWA).
 - 3. UNI-BELL Plastic Pipe Association (UNI).
- D. American Society for Testing Materials (ASTM) publications shall apply as referenced:
 - 1. C 76-85a Reinforced Concrete, Culvert, Storm Drain and Sewer Pipe.
 - 2. C 150 85a Cement, Portland.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene-monomer rubber.
- C. FRP: Fiberglass-reinforced plastic.
- D. LLDPE: Linear low-density, polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. RTRF: Glass-fiber-reinforced, thermosetting-resin fitting.
- I. RTRP: Glass-fiber-reinforced, thermosetting-resin pipe.
- J. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Submit manufacturers catalog data on pipe to be supplied.
 - 2. Special pipe fittings.
 - 3. Backwater valves.
 - 4. Drains.
 - 5. Channel drainage systems.
 - 6. Storage and leaching chambers.
 - 7. Manufacturers confirmation that products supplied comply with referenced standards.
- B. Shop Drawings: For the following:
 - 1. Manholes: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report for cast-in-place manholes.
 - 2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.
 - 3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.
 - 4. Manufacturer's catalog data. Reinforced Concrete Pipe (Storm Drain):

- a. Shop fabrication details showing materials, reinforcements, and joint details.
 - b. Field layout drawings showing location and dimensions of pipe, fittings, and connecting structures.
 - C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
 - D. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
 - E. Field quality-control test reports.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
 - B. Protect pipe, pipe fittings, and seals from dirt and damage.
 - C. Handle manholes according to manufacturer's written rigging instructions.
 - D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.
- 1.7 PROJECT CONDITIONS
- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Campus or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Campus's Representative no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Campus's Representative's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 PVC PIPE AND FITTINGS

- A. PVC Pressure Pipe: AWWA C900, Class 200, for gasketed joints and using ASTM F 477, elastomeric seals.
 - 1. Fittings NPS 4 to NPS 8: PVC pressure fittings complying with AWWA C907, for gasketed joints and using ASTM F 477, elastomeric seals.
 - 2. Fittings NPS 10 and Larger: Ductile-iron, compact fittings complying with AWWA C153, for push-on joints and using AWWA C111, rubber gaskets.
- B. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 80 pipe, with plain ends for solvent-cemented joints with ASTM D 2467, Schedule 80, socket-type fittings.
- C. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness pipe with ASTM D 3034, **SDR 35**, socket-type fittings for solvent-cemented joints.
- D. PVC Sewer Pipe and Fittings: Conforming to ASTM D 3033 or ASTM D 3034; SDR 35, with ends suitable for elastomeric gasket joints.
 - 1. Pipe: Meeting requirements of UNI-B-10-88.
 - 2. Joints and Jointing Material: Utilize an integral bell and spigot with a solid cross-section rubber gasket. Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.
 - 3. Pipe Stiffness: Minimum of 46, at 5 percent deflection, for all sizes when tested in accordance with ASTM D 2412.
 - 4. Flattening: Showing no evidence of splitting, cracking or breaking when tested as follows:
 - a. Flatten specimen of 6-inch-long pipe between parallel plates in a suitable press until the distance between the plates is 40 percent of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within two to five minutes.
 - 5. Products: Subject to compliance with requirement, provide one of the following, or equal:
 - a. Johns-Manville; Ringtite Greenbell PVC sewer pipe.
 - b. Certainteed Corporation; Fluidtite PVC sewer pipe.
- E. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-[1] [2] wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

- F. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.4 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Concrete Pipes: ASTM C 443, rubber.
 - 2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Company; a division of MCP Industries, Inc.
 - e. NDS Inc.
 - f. Plastic Oddities, Inc.
 - g. Or Equal.
- D. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg.
 - b. Dallas Specialty & Mfg. Co.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 - d. Or Equal.
- E. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
 - 1. Manufacturers:
 - a. Fernco Inc.
 - b. Logan Clay Products Company (The).
 - c. Mission Rubber Company; a division of MCP Industries, Inc.

d. Or Equal.

- F. Nonpressure-Type Rigid Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

- a. ANACO.
- b. Or Equal.

2.5 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

- a. Josam Company.
- b. MIFAB Manufacturing, Inc.
- c. Smith, Jay R. Mfg. Co.
- d. Wade Div.; Tyler Pipe.
- e. Watts Industries, Inc.
- f. Watts Industries, Inc.; Enpoco, Inc. Div.
- g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
- h. Or Equal.

2. Top-Loading Classification(s): Heavy duty.

3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

1. Manufacturers:

- a. Canplas Inc.
- b. IPS Corporation.
- c. NDS Inc.
- d. Plastic Oddities, Inc.
- e. Sioux Chief Manufacturing Company, Inc.
- f. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.
- g. Or Equal.

2.6 DRAINS

- A. Gray-Iron Area Drains: ASME A112.21.1M, round body with anchor flange and round **secured** grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.

1. Manufacturers:

- a. Josam Company.
- b. MIFAB Manufacturing, Inc.
- c. Smith, Jay R. Mfg. Co.
- d. Wade Div.; Tyler Pipe.
- e. Watts Industries, Inc.
- f. Watts Industries, Inc.; Enpoco, Inc. Div.
- g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
- h. Or Equal.

2. Top-Loading Classification(s): Heavy duty.

- B. Gray-Iron Trench Drains: ASME A112.21.1M, 6-inch- wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular secured grate. Include units of total length indicated and number of bottom outlets with inside calk or spigot connections, of sizes indicated.

1. Manufacturers:

- a. Josam Company.
- b. Smith, Jay R. Mfg. Co.
- c. Wade Div.; Tyler Pipe.
- d. Watts Industries, Inc.
- e. Watts Industries, Inc.; Enpoco, Inc. Div.
- f. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
- g. Or Equal.

2. Top-Loading Classification(s): Heavy duty.

2.7 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.

5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
11. Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint ; 10-mil minimum thickness applied to interior surfaces.
12. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
 - a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.
 - b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil minimum thickness applied to all surfaces, unless otherwise indicated.

2.8 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.
- C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.9 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 - 1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 - 2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
 - 3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 - 4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 - 5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
 - 6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
 - 7. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings. ADA Compliant grates are required in all locations.
 - 1. Size: 24 by 24 inches minimum, unless otherwise indicated.
 - 2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.
- C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch- diameter flat grate with Small Square or short-slotted drainage openings. ADA Compliant grates are required in all locations.
 - 1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.10 STORMWATER INLETS

- A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.
- B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.
- C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.
- D. Frames and Grates: Heavy-duty frames and grates according to utility standards.
- E. Curb Inlets: Vertical curb opening, of materials and dimensions indicated.

- F. Gutter Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavy-duty frames and grates.
- G. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.
- H. Frames and Grates: Dimensions, opening pattern, free area, and other attributes indicated.

2.11 STORMWATER DETENTION STRUCTURES

- A. Cast-in-Place Concrete, Stormwater Detention Structures: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
 - 1. Ballast: Increase thickness of concrete, as required to prevent flotation.
 - 2. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and cover.
- B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch- diameter cover. Include indented top design with lettering "STORM SEWER" cast into cover.

2.12 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
 - 1. Average Size: NSSGA No. R-3, screen opening 2 inches.
 - 2. Average Size: NSSGA No. R-4, screen opening 3 inches.
 - 3. Average Size: NSSGA No. R-5, screen opening 5 inches.
- C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size, graded stone.
- D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

2.13 STORMWATER DISPOSAL SYSTEMS

- A. Chamber Systems:
 - 1. Manufacturers:
 - a. Advanced Drainage Systems, Inc.

- b. Cultec, Inc.
 - c. Hancor, Inc.
 - d. Infiltrator Systems, Inc.
 - e. Or Equal.
 - 2. Storage and Leaching Chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
 - 3. Filtering Material: ASTM D 448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel.
 - 4. Filter Mat: Geotextile woven or spun filter fabric, in 1 or more layers, for minimum total unit weight of 4 oz./sq. yd..
- B. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M 252M for NPS 10 and smaller, AASHTO M 294M for NPS 12 to NPS 48, and AASHTO MP7 for NPS 54 and NPS 60. Include proprietary fittings, couplings, seals, and filter fabric.
- 1. Manufacturers:
 - a. Advanced Drainage Systems, Inc.
 - b. Hancor, Inc.
 - c. Or Equal.

2.14 MISCELLANEOUS MATERIALS

- A. Paint: SSPC-Paint 16.
- B. PE Sheeting: ASTM D 4397, with at least 8-mil thickness or other equivalent, impervious material.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 STORAGE OF MATERIALS

- A. Inspect all materials delivered to the site for damage. Store materials on site in enclosures or under protective covering out of direct sunlight. Do not store materials directly on ground. Keep inside of pipes and fittings free of dirt and debris.

3.3 PIPING APPLICATIONS

- A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Unshielded flexible or rigid couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 2. Use pressure-type pipe couplings for force-main joints.
- B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- C. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:
1. NPS 3: ABS, SDR 35, sewer pipe and fittings; gaskets; and gasketed joints.
 2. NPS 3: NPS 4 PVC sewer pipe and fittings; gaskets; and gasketed joints.
 3. NPS 4 and NPS 6: Cellular-core PVC pipe, PVC sewer pipe fittings, and solvent-cemented joints.
 4. NPS 4 and NPS 6: PVC sewer pipe and fittings, gaskets, and gasketed joints.
 5. NPS 8 to NPS 12: PVC sewer pipe and fittings, gaskets, and gasketed joints.
 6. NPS 8 to NPS 12: PVC profile gravity sewer pipe and fittings, gaskets, and gasketed joints.
 7. NPS 15: PVC sewer pipe and fittings, gaskets, and gasketed joints.
 8. NPS 15: PVC profile gravity sewer pipe and fittings, gaskets, and gasketed joints.
 9. NPS 18 to NPS 36: PVC sewer pipe and fittings, gaskets, and gasketed joints.
 10. NPS 18 to NPS 36: PVC profile gravity sewer pipe and fittings, gaskets, and gasketed joints.

3.4 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install pipe in accordance with ASTM D 2321, UNI-B-5 and the following:
1. Inspect each pipe and fitting before lowering the pipe or fitting into the trench. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
 2. Use implements, tools, and facilities for the safe and proper protection of the pipe. Handle pipe in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.

3. When installing piping in trenches, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.
 4. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of bedding. Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.
 5. At the location of each joint, dig bell (joint) holes in the bottom of the trench and at the sides to permit visual inspection of the entire joint.
 6. Provide and maintain means and devices at all times to remove and dispose of all water entering the trench during the process of pipelaying. The trench shall be kept dry until the pipelaying and jointing are completed. Removal of water shall be in conformance with specifications in Section 01065.
 7. When the pipelaying is not in progress, including the noon hours, close the open ends of pipe. Do not permit trench water, animals, or foreign material to enter the pipe.
 8. Lay pipe without break, upgrade from structure to structure, with the bell ends of the pipe upgrade.
 9. Do not use the pipe as a drain for removing water that has infiltrated into the trench.
 10. After joint assembly, bring the bedding material up to 1 foot above the top of the pipe. Place and compact the imported sand as directed in Section 02300. The remainder of the backfill shall be native earth backfill, installed per Section 02300.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
 2. Install piping with 36-inch minimum cover.
 3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 4. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

3.5 PIPE JOINT CONSTRUCTION

- A. Apply the joint manufacturer's lubricant to the pipe spigot to assemble the joint. Follow the manufacturer's instructions. Make joints water tight and root tight.

- B. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
 - 2. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
 - 3. Join dissimilar pipe materials with nonpressure-type flexible or rigid couplings.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.7 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
 - 1. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.
- B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.
- E. Assemble trench sections with flanged joints.
- F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.8 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections according to ASTM C 891.
- C. Construct cast-in-place manholes as indicated.
- D. Install PE sheeting on earth where cast-in-place-concrete manholes are to be built.
- E. Install FRP manholes according to manufacturer's written instructions.

- F. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.9 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.10 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

3.11 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.12 DRAINAGE SYSTEM INSTALLATION

- A. Assemble and install components according to manufacturer's written instructions.
- B. Install with top surfaces of components, except piping, flush with finished surface.
- C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
- D. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.
- E. Fasten grates to channel sections if indicated.
- F. Assemble channel sections with flanged or interlocking joints.
- G. Embed channel sections in 4-inch minimum concrete around bottom and sides.

3.13 STORMWATER DISPOSAL SYSTEM INSTALLATION

- A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill according to chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.
- B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill according to piping manufacturer's written instructions.

3.14 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 15 Section "Storm Drainage Piping."
- B. Connect force-main pressure piping to building's storm drainage force mains specified in Division 15 Section "Storm Drainage Piping." Terminate piping where indicated.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 - 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.15 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
1. Remove manhole or structure and close open ends of remaining piping.
 2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Division 2 Section "Earthwork."

3.16 PAINTING

- A. Clean and prepare concrete manhole surfaces for field painting. Remove loose efflorescence, chalk, dust, grease, oils, and release agents. Roughen surface as required to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:
1. Cast-in-Place-Concrete Manholes: All interior.
 2. Precast Concrete Manholes: All interior.
- B. Prepare ferrous frame and cover surfaces according to SSPC-PA 1 and paint according to SSPC-PA 1 and SSPC-Paint 16. Do not paint surfaces with foundry-applied, corrosion-resistant coating.

3.17 IDENTIFICATION

- A. Materials and their installation are specified in division 2 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.18 TESTING FOR ALIGNMENT

- A. After the pipe has been installed, tested for leakage, backfilled to existing grade, and manholes raised to grade and resurfaced, "ball" the pipe from manhole with a sewer scrubbing ball. After balling the pipe, perform the following:
- B. "Mirror" straight sewers and inlet/outlet ends of curvilinear sewers. Perform balling and mirroring in the presence of the Campus's Representative to test for alignment, grade, damage or defective pipe in place, or any other type of faulty installation. Should

balling and mirroring indicate any faulty installation of the pipe, repairs or replacements shall be made at the Contractor's expense.

3.19 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924.
 - 6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.
 - a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
 - b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
- C. Leaks and loss in test pressure constitute defects that must be repaired.

- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.20 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

3.21 CLOSEOUT DOCUMENTATION

- A. Video Documentation: Upon completion of sitework, hardscaping, landscaping and pipe cleaning, televise and record on DVD storm drain piping installed as part of the Project (outside the building footprint) as follows:
 - 1. Notify Project Inspector at least two days prior to scheduled recording.
 - 2. Include audio narration.
- B. Report: Prepare a written report of the video documentation, including the following:
 - 1. Camera location, identified by Campus's storm drain numbering system.
 - 2. Pipe sections being viewed.
 - a. Markup pipe section in conjunction with storm drain Drawings.
- C. Submit DVD, written report, and Drawing markups to Campus in accordance with Division 1 Section "Project Closeout."

END OF SECTION 33 41 00