

**PROJECT MANUAL FOR
PALMDALE SCHOOL DISTRICT
PALMDALE ELOP CENTER
PHASE 1A**

DSA APPLICATION NO. 03-125960
LIONAKIS NO. 025112.01

DSA Backcheck Specifications

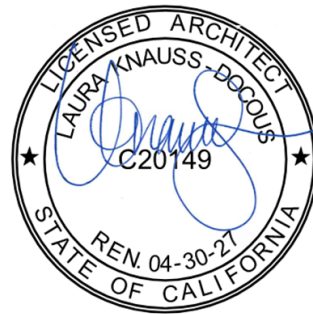
July 1, 2026

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FOR
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PALMDALE ELOP CENTER
PHASE 1A

DSA NO. 03-125960

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Specification Sections listed below are supplementary to requirements indicated on the PC Drawings.

Where Sections of the Specifications listed below are in conflict with, or duplicative of requirements indicated on the PC Drawings, these Specifications shall govern the non-PC scope, and the PC Drawings shall govern the PC scope.

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SECTION 01 31 14

ADDITIONAL REQUIREMENTS FOR DSA REVIEWED PROJECTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Additional requirements for projects reviewed by the Division of the State Architect (DSA).

1.2 RELATED SECTIONS

- A. Section 01 70 00 – Execution and Closeout Requirements: Project closeout requirements.

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. California Code of Regulations (CCR).
 - 1. Title 8, Division 1, Chapter 3.2 – California Occupational Safety and Health Regulations (Cal/OSHA).
 - 2. Title 8, Division 1, Chapter 4, Sub-Chapter 4 – Construction Safety Orders.
 - 3. Title 8, Division 1, Chapter 4, Sub-Chapter 7 – General Industry Safety Orders.
 - 4. Title 19, Division 1 – State Fire Marshal (SFM).
 - 5. California Code of Regulations, Title 24, Part 1 - California Administrative Code.
 - a. All Code Section numbers in this Section refer to Chapter 4 “Administrative Regulations for the Division of the State Architect – Structural Safety”, Group 1 “Safety of Construction of Public Schools”.
- D. Division of the State Architect Interpretation of Regulations Manual (DSA IR).
 - 1. DSA IR A-6 – Construction Change Document Submittal and Approval Process.
 - 2. DSA IR A-7 – Project Inspector Certification and Approval.
 - 3. DSA IR A-8 – Project Inspector and Assistant Inspector Duties and Performance.
 - 4. DSA IR A-12 – Assistant Inspector Approval.
- E. Division of the State Architect Website: www.dsa.dgs.ca.gov.

1.4 GENERAL REQUIREMENTS

- A. Contractor’s Duties:
 - 1. Comply with California Administrative Code, Chapter 4, Article 6, Paragraph 4-343, “Duties of the Contractor” in addition to the duties described in the Contract Documents.
 - 2. Comply with CCR Title 8, Division 1, Chapter 3.2, California Occupational Safety and Health Regulations (Cal/OSHA).

3. Comply with CCR Title 8, Division 1, Chapter 4, Sub-Chapter 4, Construction Safety Orders.
4. Comply with requirements of CCR Title 19, Division 1, State Fire Marshal (SFM).
- B. Architect's and Architect's Consultants' Duties: Comply with requirements of California Administrative Code, Chapter 4, Article 6, Paragraph 4-341, "Duties of the Architect, Structural Engineer or Professional Engineer" and Paragraph 4-344, "Duties of Mechanical and Electrical Engineers", in addition to the duties described in the Contract Documents.
- C. Arbitration: DSA is not subject to arbitration proceedings.
- D. Should any existing conditions such as deterioration or non-complying 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 (CCR), a Construction Change Document (CCD), or a separate set of Drawings and Specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.

1.5 REGULATORY REQUIREMENTS

- A. Perform all work in accordance with applicable laws, codes, ordinances, rules, and regulations including, without limitation, 2022 California Building Code (CBC) Parts 1 through 6, Part 9, and Part 12 in accordance with Title 24, Part 1, 4-305. Maintain a copy of these documents at the project site at all times.
- B. Codes adopted by the City, County, State, and Federal agencies govern minimum project requirements. Comply with the latest edition of applicable regulatory requirements and standards unless otherwise indicated or specified.
- C. Work as described in Drawings and Specifications shall not be construed as to permit work not in accordance with applicable laws, codes, ordinances, rules, and regulations.

1.6 INSPECTION AND SUPERVISION

- A. Supervision by DSA shall be in accordance with California Administrative Code, Chapter 4, Article 5, Paragraph 4-334.
- B. Owner shall select and pay for the services of a Project Inspector, certified and approved by the Architect, the Structural Engineer (when applicable), and DSA in accordance with Title 24, Part 1, 4-333(b).
 1. When required, Owner will select and pay for the services of additional full-time Assistant Project Inspector(s) certified and approved by DSA in accordance with DSA IR A-12.
- C. Project Inspector shall have and maintain on the job at all times, the edition of CCR Title 24, Part 1 through Part 6 referred to in the Drawings and Project Manual per Title 24, Part 1, 4-342(b)3.
- D. Project Inspector shall inspect construction in accordance with California Administrative Code, Chapter 4, Article 5, Paragraph 4-333(b), "Inspection by a Project Inspector", and Article 6, Paragraph 4-342, "Duties of the Project Inspector", and DSA IR A-8.
 1. Project Inspector performance rating by DSA shall be in accordance with DSA IR A-8, Section 3.1, "Project Inspector Performance Review".

- E. Reports: Project Inspector shall submit the following:
 - 1. Semi-Monthly Reports: Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-337.
 - 2. Verified Reports: Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-336.
- F. Special Inspection Requirements:
 - 1. Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-333(c), "Special Inspection".
 - 2. Special inspection costs to be paid by Owner.
 - 3. Conduct special inspection in accordance with DSA-103, Statement of Structural Tests and Inspections.

1.7 TESTING AGENCY REQUIREMENTS

- A. Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-335, "Structural Tests and Special Inspections".
- B. Owner will select and pay for the services of a Testing Lab, certified and approved by the Architect, the Structural Engineer (when applicable), and DSA in accordance with Title 24, Part 1, 4-333(b).
- C. Sampling and testing shall be performed by properly qualified persons in accordance with applicable American Society for Testing and Materials (ASTM) standards.
- D. Conduct tests in accordance with DSA-103, Statement of Structural Tests and Inspections.
- E. Submit 1 copy of test reports to DSA.

1.8 SUBSTITUTIONS AND REQUESTS FOR INFORMATION

- A. Substitutions and Requests for Information (RFIs) that affect structural safety, fire and life safety, access compliance, or energy (as applicable) are Construction Change Documents and shall be submitted to DSA for review and approval prior to fabrication and installation on the project.

1.9 ADDENDA AND CONSTRUCTION CHANGES

- A. Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-338, "Addenda and Construction Changes".
 - 1. Addenda and Construction Changes, including supplementary drawings when applicable, shall be signed and stamped by the Architect and approved by DSA in accordance with Title 24, Part 1, 4-338(b).
- B. Comply with DSA IR A-6.
- C. Obtain DSA approval for changes to DSA approved Drawings and Specifications which affect Code-regulated construction and inspection/testing functions prior to start of that Work. Code-regulated construction refers to Work that is regulated by Code provisions applicable to public school construction, including those adopted by Division of the State Architect-Structural Safety Section (DSA/SS), Division of the State Architect-Access Compliance Section (DSA/AC), and Division of the State Architect-Fire and Life Safety Section (DSA/FLS).

1. All changes, substitutions, and Requests for Information (RFIs) that affect Structural Safety, Fire and Life Safety, Access Compliance, or Energy, as applicable, shall be submitted to DSA for review and approval as a Construction Change Document (CCD) prior to fabrication and installation of the Work in accordance with DSA IR A-6 and Title 24, Part 1, 4-338(c). Substitutions shall be for any material, system, or product that would otherwise be regulated by DSA.
- D. Changes can be approved by DSA through the CCD Category A or the CCD Category B review process, as applicable. Comply with DSA IR A-6, Article 3, Section 3.1, "CCD Category A" and DSA IR A-6, Article 3, Section 3.2, "CCD Category B".
 1. CCD Category A is defined as changes to or affecting the Structural, Access, or Fire-Life safety portions of the Project.
 2. CCD Category B is defined as changes not affecting the Structural, Access, or Fire-Life safety portions of the Project.
 3. Construction Change Documents (Section 4-338(c)) must be signed by all of the following: A/E of Record, Structural Engineer (when applicable), Delegated Professional Engineer (when applicable), and DSA.
- E. Do not begin any work under addendum or construction changes until required DSA written approval is obtained.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Contractor's construction progress schedules.
- C. Shop drawings.
- D. Proposed products list.
- E. Product data.
- F. Samples.
- G. Design Data.
- H. Test Reports.
- I. Manufacturers' instructions.
- J. Manufacturer's field reports.
- K. Manufacturers' certificates.

1.2 RELATED SECTIONS

- A. Section 01 60 00 – Product Requirements: Substitutions.
- B. Section 01 70 00 – Execution and Closeout Requirements; for Contract warranties and manufacturer's certificates closeout submittals.

1.3 SUBMITTAL PROCEDURES

A. Electronic File Availability:

1. Architect's electronic drawing files for this project will be available to Contractor upon written request. The request shall include the drawing sheet number of each drawing being requested. Architect shall respond to the written request using the Delivery of Electronic Files Agreement Form attached at the end of this Section. Contractor shall sign and date the form and return it to Architect prior to the electronic files being delivered to Contractor.
 - a. Electronic drawing files developed by Architect's Consultants for this project may be available under separate agreement with each consultant. Refer to the directory on the Title/Cover Drawing Sheet for listing of consultant information.
2. Architect's Building Information Model (BIM) for this project will be available to Contractor upon written request. Architect shall respond to the written request using the Delivery of BIM Agreement Form attached at the end of this Section. Contractor shall sign and date the form, return it to Architect prior to the BIM files being delivered to Contractor.

- B. All submittals shall be provided in electronic format using software acceptable to Architect.

- C. Transmit each submittal with a Submittal Form acceptable to Architect. Limit each transmittal to a single submittal item or series of related items.
- D. Sequentially number the transmittal forms. Resubmittals shall retain original number with an alphabetic suffix.
- E. Identify Project, Contractor, Subcontractor or Supplier; pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.
- F. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and the Contract Documents.
- G. Schedule submittals in accordance with construction to expedite the Project, and deliver to Architect at business address. Coordinate submission of related items.
- H. Unless otherwise agreed upon in advance, all submittals required within any one specification Section shall be submitted at the same time, in a single package.
- I. Identify variations from the Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.
- J. Revise and resubmit submittals as required, identify all changes made since previous submittal; re-submit within such time as necessary to avoid delay to the Work of the re-submitted item, related Work, and the Project.
- K. Acceptance of submittals by Architect is general in nature and shall not relieve Contractor from responsibility for proper fitting and construction of work, nor from furnishing products, materials, and work required by Contract which may not be indicated on submittals.
- L. No portion of Work requiring submittals shall be commenced until submittal has been reviewed and accepted by Architect. All such portions of Work shall be in accordance with accepted submittals.
- M. Distribute Architect reviewed submittals electronically to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
- N. Submit requests for substitution under provisions of Section 01 60 00.

1.4 CONTRACTOR'S CONSTRUCTION PROGRESS SCHEDULE

- A. Within 30 days after the Notice to Proceed submit a fully developed, Contractor's Construction Progress Schedule which meets the following minimum criteria:
 - 1. Submit a computer-generated schedule generated using Primavera P6 or equivalent CPM scheduling software, with a separate timeline for each significant construction activity.
 - a. Equivalency of a proposed substitute CPM scheduling software shall be determined by the Architect at their sole discretion at Contractor's request.
 - 2. Critical Path Management (CPM) Network Definition: CPM network is a graphic description of the construction plan, showing the sequential steps needed to reach the completion of the Work. It shall depict events and tasks, and their interrelationships, and shall recognize the progress that must be made in one task before subsequent tasks can begin. The CPM network shall be comprehensive and shall include all interdependencies and interactions required to perform the Work of the Project. The only activity in the schedule that will not have a predecessor is the Project Start or Notice to Proceed

- Milestone. The only activity in the schedule that will not have a successor is the Project Completion Milestone. All other activities in the schedule shall have predecessor and successor logic ties.
3. Contractor shall submit the schedule in Portable Document Format (PDF). Contractor shall also submit an electronic copy of the data used to produce the PDF submittal in a format compatible with Primavera P6, unless an equivalent CPM scheduling software has been accepted by Architect.
 4. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work. Indicate early/late start, early/late finish, float dates, and duration.
 5. Coordinate Contractor's Construction Progress Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules. Indicate submittal dates on the schedule for shop drawings, product data, samples, and product delivery dates.
 6. Schedule shall allow time for Project closeout procedures.
 7. Indicate Final Completion date on Progress Schedule.
 - a. Construction Progress Schedule Final Completion date shall be the same as contractual completion date. If dates differ, Construction Progress Schedule will be returned without review.
- B. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
- C. In the event the contractor submits a viable, contractually compliant construction schedule which indicates project completion at a date earlier than the contractually provided contract duration, the acceptance of such a schedule will not change the contract time. In such an event, a schedule activity entitled project float, of a duration equal to the difference between the proposed construction duration and the contract duration, will be added to the schedule. All project float is a project resource for the Contractor and the Owner, and is not for the exclusive use of either party.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area shall be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the Schedule, provide a two item cost correlation line, indicating precalculated and actual costs. On the line show dollar-volume of Work performed as of the dates used for preparation of payment requests.
- F. Initial Schedule will be reviewed by Architect and Owner solely to ensure compliance with the Contract Documents. Architect's response to Contractor will indicate acceptance if the Schedule complies with the Contract Documents, or non-acceptance if it does not comply with the Contract Documents.
- G. Distribution: After Architect's review of entire Construction Progress Schedule, distribute the schedule electronically to Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

H. Revisions to the Construction Progress Schedule shall be as follows:

1. Contractor shall not revise the contractual completion date without an executed Change Order.
2. All revisions shall accurately reflect the Record Schedule as of date of revision.
3. Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the revised schedule concurrently with the minutes of each meeting. A combined 3 week Look-Ahead Schedule with a 1 week Record Schedule for the previous week shall be submitted by Contractor to Owner and Architect for review at each progress meeting. The Contractor shall status the schedule on a weekly basis. This Look-Ahead Schedule shall be derived from this weekly statusing. The cumulative status of the Look-Ahead schedules shall be the basis for the Monthly Update submittal. In no event shall the Contractor utilize a separate schedule for generation and maintenance of the Look-Ahead schedules. If the superintendent's and revised Baseline Schedule schedule's logic deviate significantly, a reconciliation of the 2 schedules shall be required.
4. Revise the Schedule at the time of each Application for Payment, and clearly identify changes from the previous version. Submit the revised Schedule with the Applications for Payment. Payments are conditional upon Contractor providing the updated schedule.

I. No more than 20 percent of the total number of activities shown on the schedule shall be critical or near critical. Near critical is defined as float less than 10 days.

J. Include a critical path activity titled Remaining Inclement Weather Days on the Initial Contract Schedule. This activity shall have an initial duration equal to the number of days shown in the West Regional Climate Center website: <https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6624>; on the left side scroll down to General Climate Summary Tables, then click on Precipitation. The inclement weather days with 0.10 inch of precipitation or greater are the average number of monthly inclement weather days normally experienced within the region, and are non-compensable. The total number of days used for the initial duration shall be equal to the contract time indicated in the Contract Documents and the specific months of construction. It shall be the last activity in the schedule prior to the activity titled Contract Completion. All predecessor activities must pass through the Inclement Weather Days activity. Contractor shall apply to Architect to use an Inclement Weather Day when a critical path activity has been delayed because of inclement weather. This application shall occur in the same month as the inclement weather delay. The Remaining Inclement Weather Days activity shall not be statused with an actual start or finish date, or percentage of completion. Rather, it is a graphical accounting tool where the original duration shall be reduced by the agreed to weather impact. Inclement Weather Delays to non-critical activities will not be considered. Inclement Weather Days with actual daily rainfall less than 0.10 inch will not be considered. If, at Completion, there are inclement weather days still remaining, the Completion date shall not be adjusted. If, at completion, additional inclement weather days are required, Owner shall adjust the Completion date accordingly. Any time extension granted to Contractor due to inclement weather delays shall be in the form of non-compensable days.

K. As a condition precedent to final acceptance of the Project, submit a final Record Construction Schedule and all final reports which accurately reflect the manner in which the Project was constructed and includes actual start and completion dates for all work activities on the Baseline Schedule.

1.5 SHOP DRAWINGS

A. Shop Drawings: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

- B. Shop drawings that are copies of the Contract Document drawings are not allowed.
- C. Provide shop drawings to scale showing all details of proposed construction. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. When required by individual specification Sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
 - 1. Include signed and sealed calculations to support design.
 - 2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 - 3. Make revisions and provide additional information when required by authorities having jurisdiction.
- E. Submit shop drawings in electronic format.
 - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
- F. After review and acceptance by Architect, Contractor shall distribute electronically to concerned parties and provide copies for Record Documents described in Section 01 70 00.

1.6 PROPOSED PRODUCTS LIST

- A. Within 15 days after the date of the Owner-Contractor Agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.7 PRODUCT DATA

- A. Product Data: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit product data as required by individual Specification Sections.
- C. Submit product data in electronic format.
 - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
- D. Mark each submittal to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
- E. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

- F. After review and acceptance by Architect, Contractor shall distribute electronically to concerned parties and provide copies for Record Documents described in Section 01 70 00.
- G. Maintain a copy of all Material and Safety Data Sheets (MSDS) at the jobsite at all times, and be ready to furnish MSDS upon request or have ready access to MSDS in emergencies.

1.8 SAMPLES

- A. Samples: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit samples to illustrate functional and aesthetic characteristics of products, 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's selection.
- D. Include identification on each sample, with complete product information.
- E. Submit the number of samples specified in individual specification Sections plus 1 additional sample which will be retained by Architect. Provide a minimum of 2 samples.
- F. Reviewed samples which may be used in the Work are indicated in individual specification Sections.
- G. Samples will not be used for testing purposes unless specifically stated in specification Section.

1.9 DESIGN DATA

- A. Submit for Architect's knowledge as contract administrator or for Owner.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 TEST REPORTS

- A. Submit for Architect's knowledge as contract administrator or for Owner.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.11 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification Sections, submit manufacturers' written instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for Product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- C. Identify conflicts between manufacturers' written instructions and the Contract Documents.

1.12 MANUFACTURER'S FIELD REPORTS

- A. Submit reports for Architect's benefit as contract administrator or for Owner.

- B. Submit report within 3 days of observation to Architect for information.
- C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.13 MANUFACTURER'S CERTIFICATES

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

DELIVERY OF ELECTRONIC FILES AGREEMENT FORM

Date: _____

Recipient's Name: _____

Recipient's Address: _____

Project: _____

At your request, Lionakis will provide Architectural and/or Engineering electronic files of the images depicted on each drawing sheet for your convenience and use in the preparation of shop drawings related to _____, subject to the following terms and conditions:

Lionakis makes no representation as to the compatibility of electronic files with your hardware or your software.

Data contained in these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving these data through or from you for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to Lionakis. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against Lionakis, Lionakis' officers, directors, employees, agents or sub-consultants that may arise out of or in connection with your use of the electronic files.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold Lionakis harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from your use of these electronic files.

These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction, as-built, or record documents. Lionakis makes no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed and sealed hard-copy construction documents prepared by Lionakis and the electronic files, the signed and sealed hard-copy construction documents shall govern.

You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the Contract Documents, including, but not limited to, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with the work of others for the project.

Because information presented in the electronic files can be modified, unintentionally or otherwise, Lionakis reserves the right to remove all indications of ownership and/or involvement from each electronic file.

Lionakis will furnish you electronic files of the following Architectural and/or Engineering drawing sheets:

Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by Lionakis, and Lionakis makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall Lionakis be liable for any loss of profit or any consequential damages as a result of your use or reuse of these electronic files.

Electronic files will be sent to you after signed acknowledgement of this letter is received by Lionakis.

Accepted By:

Recipient: _____

Company: _____

Address: _____

City, State, ZIP: _____

Recipient's Signature: _____ Date: _____

Printed Name: _____

Title: _____

DELIVERY OF BIM AGREEMENT FORM

Date: _____

Recipient's Name: _____

Recipient's Address: _____

Project: _____

At your request, Lionakis will provide the Building Information Model (BIM) for your convenience and use related to the Project, subject to the following terms and conditions:

Lionakis makes no representation as to the compatibility of the BIM with your hardware or your software beyond the specified release of the applicable software.

Data contained in the BIM is part of our instruments of service and shall not be used by you or anyone else receiving this data through or from you for any purpose other than as a convenience. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to Lionakis. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against Lionakis, Lionakis' officers, directors, employees, agents or sub-consultants that may arise out of or in connection with your use of the BIM.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold Lionakis harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from your use of the BIM.

This BIM is not a construction document. Differences may exist between the BIM and corresponding hard-copy construction documents, as-built documents, or record documents. Lionakis makes no representation regarding the accuracy or completeness of the BIM you receive. In the event that a conflict arises between the signed and sealed hard-copy construction documents prepared by Lionakis and the BIM, the signed and sealed hard-copy construction documents shall govern.

You, or any party to which this BIM is distributed, are responsible for determining if conflicts exist. By your use of this BIM, you are not relieved of your duty to fully comply with the construction documents, including, but not limited to, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with the work of others for the Project.

Because information presented in the BIM can be modified, unintentionally or otherwise, Lionakis reserves the right to remove all indications of ownership and/or involvement from the BIM.

Under no circumstances shall delivery of the BIM for use by you be deemed a sale by Lionakis, and Lionakis makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall Lionakis be liable for any loss of profit or any consequential damages as a result of your use or reuse of the BIM. The BIM shall be provided in Revit 20__.

Lionakis will provide you with the following BIM files:

The BIM files will be sent to you after signed acknowledgement of this letter is received by Lionakis.

Accepted By:

Recipient: _____

Company: _____

Address: _____

City, State, ZIP: _____

Recipient's Signature: _____ Date: _____

Printed Name: _____

Title: _____

SECTION 01 35 16
ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products and installation procedures for patching and extending Work.
- B. Transitions and adjustments.
- C. Repair of damaged surfaces and finishes.
- D. Cleaning.

1.2 RELATED SECTIONS

- A. Section 01 73 29 – Cutting and Patching.
- B. Section 02 41 00 – Demolition.

1.3 ALTERATIONS, CUTTING, AND PROTECTION

- A. Perform Work of this Section under provisions of CBC Chapter 33, CFC Chapters 33 and 35, and NFPA 241.
- B. Assign the work of relocating, removal, cutting, and patching of products, materials, equipment and systems to trades qualified to perform the work, in a manner to cause the least damage to existing surfaces and provide a means of returning surfaces to the level of quality of new Work.
- C. Perform cutting and removal work to remove the minimum amount of materials necessary to accommodate new Work and in a manner to avoid damage to adjacent work.
 - 1. Cut finish surfaces such as concrete, masonry, drywall, plaster, or metals in a straight line at a natural point of division or where required to perform the specified work.
- D. Protect existing finishes, equipment, and adjacent work that are scheduled to remain from damage.
 - 1. Close openings in exterior surfaces to protect existing and new Work from extremes of temperature.
 - a. Maintain existing interior work above 60 degrees F and below 85 degrees F.
 - b. Provide heat and humidity control as needed to prevent damage to existing work and to new Work.
- E. Provide temporary enclosures to separate work areas within the building and from areas occupied by Owner. Temporary construction barriers shall match the fire rating of the separation barrier being breached. Fire retardant plastic dust barrier shall only be used where there is no fire rating required between the work area and adjacent spaces.
- F. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction. When exit routes

need to be altered due to construction operations, provide proposed alternate exit route for Owner and DSA review and approval. Proposal shall include, but not be limited to, alternate exit route, temporary directional signage, and personnel to redirect building occupants during entire duration of exit route blockage.

- G. Coordinate and obtain Owner's approval of construction activity path of travel from outside of building to the areas of work inside the facility.
- H. Hazardous Materials:
 - 1. Existing conditions and Work to be accomplished under this Contract do not deal with the possible or actual existence of hazardous materials (Hazmat), such as asbestos-containing materials, lead-based paint, PCBs, etc.
 - 2. If there is a possibility of disturbing or contacting surfaces or materials containing hazardous materials (Hazmat) during execution of Work under this Contract, Contractor shall suspend Work in that area, immediately inform Owner and Architect, and follow directions and Hazmat-related procedures provided by Owner.
- I. Provide not less than 5 days' notice to Owner of activities that will affect Owner's operations.
 - 1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated.

PART 2 PRODUCTS

2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

- A. New Materials: As specified in product Sections; match existing products, materials, equipment, and systems for patching and extending work.
 - 1. Provide same products, materials, or types of construction as that in existing structure as required to patch, extend, or match existing work.
 - 2. A product, finish, or type of construction that requires patching, extending, or matching shall be installed as necessary to complete the Work and match the consistency of adjacent standards of quality.
- B. Type and Quality of Existing Products: Determine by inspection and testing of products where necessary, referring to existing Work as a standard.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that demolition is complete, and areas are ready for installation of new Work.
- B. Beginning of restoration Work means acceptance of existing conditions.

3.2 PREPARATION

- A. Cut, move, or remove items as necessary for access to alteration and renovation Work at no additional cost to Owner. Replace and restore assemblies at completion to like new condition.

- B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as required to receive finished Work.
- C. Remove all debris and abandoned items from area and from concealed spaces.
- D. Remove surface finishes and prepare surfaces for proper installation of new Work and finishes.

3.3 INSTALLATION

- A. Coordinate alteration and renovation work to expedite completion and to accommodate Owner occupancy. Patch and extend existing work using skilled mechanics that are capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new Work.
- B. Room Finishes: Complete in all respects including operational mechanical and electrical work.
- C. Remove, cut, and patch items as necessary for access to alterations and renovation Work in a manner to minimize damage and to provide a means of restoring products and finishes to specified condition.
- D. Refinish visible existing surfaces to remain in renovated rooms and spaces to specified condition for each material with a neat and flush transition to adjacent finishes.
- E. Restore existing plumbing, heating, ventilation, air conditioning, and electrical systems to full operational condition.
- F. Install products using procedures specified in individual product Sections to match existing products and finishes.
- G. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

3.4 TRANSITIONS

- A. Where new Work abuts or aligns with existing, provide a smooth and even transition.
- B. Patch Work to match existing adjacent Work in texture and appearance, without breaks, steps, or bulkheads.
- C. When finished surfaces are cut and a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division. Make transition recommendation to Architect prior to proceeding with the Work.

3.5 ADJUSTMENTS

- A. Where change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition to Architect.
 - 1. Where extreme change of plane of 2 inches or more occurs, request from Architect direction for making transition.
- B. Trim existing doors as necessary to clear new floor finish. Refinish trimmed area as required to match door finish.

- C. All openings for surface penetrations shall be cut uniformly around and sealed and closed tight to penetrating elements.

3.6 REPAIR OF DAMAGED SURFACES

- A. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing other imperfections at no additional cost to Owner.
- B. Repair substrate prior to patching finish.

3.7 FINISHES

- A. Finish surfaces as specified in individual product Sections.
- B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.8 CLEANING

- A. Clean adjacent Owner-occupied areas of work soiled by work of this Contract.

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. References.
- B. Quality assurance.
- C. Tolerances.
- D. Labeling.
- E. Seismic considerations.
- F. Mockups, when specified in other Sections.
- G. Field samples.
- H. Inspection and testing laboratory services.
- I. Manufacturers' field services and reports.

1.2 RELATED SECTIONS

- A. Section 01 33 00 – Submittal Procedures: Submission of Manufacturers' Instructions and Certificates.
- B. Section 01 60 00 – Product Requirements: Requirements for material and product quality.
- C. Section 01 73 29 – Cutting and Patching: For repair and restoration of construction disturbed by testing and inspection activities.

1.3 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable Codes.
- B. Conform to reference standard by date of issue current on date for receiving bids, except where specific date is established by Code.
- C. Obtain copies of standards where required by product specification Sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in reference documents.
- F. Contractor shall be responsible for being current and knowledgeable in building codes applicable to all trades under their direction.

- G. Provide all work and materials in full accordance with the latest Rules and Regulations of the California Code of Regulations, Title 24, California Building Code, California Mechanical Code, California Plumbing Code, California Electrical Code, California Fire Code; Title 19, Division 1, State Fire Marshal; applicable requirements of Title 8, Division 1, Department of Industrial Relations; and other applicable laws or regulations. Nothing in Drawings and Specifications shall be construed to permit work not conforming to these Codes.
- H. Furnish additional material and labor as required to comply with applicable Rules and Regulations.

1.4 QUALIFICATIONS

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product, that are similar to those indicated for this Project in material, design, and extent.
- E. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A Nationally Recognized Testing Laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to National Voluntary Laboratory Accreditation Program (NVLAP) by National Institute of Standards and Technology (NIST).

1.5 QUALITY ASSURANCE

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' written installation instructions, including each step in sequence.
- C. When manufacturers' written installation instructions conflict with the Contract Documents, request clarification from Architect before proceeding.

- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Work shall be performed by persons qualified to produce workmanship of specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- H. Contractor's Line of Authority: Contractor shall provide one person who shall be both knowledgeable and responsible for all work to be performed on this project at all times during normal work hours. In Contractor's absence, Contractor's appointed representative shall be responsible for all directions given and said directions shall be binding as if given to Contractor. Contractor's representative shall be responsible to coordinate all work to be performed.
- I. Shop and field work shall be performed by mechanics skilled and experienced in the fabrication and installation of the work involved. All work on this project shall be done in accordance with the best practices of the various trades involved and in accordance with Drawings, accepted shop drawings, and Specifications.
- J. All work shall be erected and installed plumb, level, square and true, and in proper alignment and relationship to the work of other trades. All finished work shall be free from defects. Architect reserves the right to reject any materials and workmanship that are not considered to be up to the highest standards of the various trades involved. Such inferior material or workmanship shall be replaced at no cost to Owner.
- K. All work shall be installed by knowledgeable installers and defined Eligible by the specified materials manufacturers. Specifications and recommendations of the manufacturer, whose materials are used, shall be strictly adhered to during application or installation of materials.
- L. Any additional work beyond that specified or illustrated, or any modification thereto, that is necessary for the furnishing of warranty shall be provided by Contractor at no cost to Owner.

1.6 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.7 LABELING

- A. Attach label from agency as required by Title 24 for products, assemblies, and systems required to be labeled by California Building Code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
 - 1. Model number.

2. Serial number.
3. Performance characteristics.

1.8 SEISMIC CONSIDERATIONS

A. Main Wind-Or Seismic-Force-Resisting System Requirements:

1. Contractor Responsibility: Contractor shall submit a written statement of responsibility to the building official and Owner prior to commencement of work on designated seismic system or wind- or seismic-resisting component, listed in the statement of special inspections, in accordance with 2025 California Building Code (CBC), Chapter 17A "Special Inspections and Tests", Section 1704A.4 "Special Inspections and Tests, Contractor Responsibility and Structural Observations".

B. Seismic Certification of Nonstructural Components:

1. The manufacturer of each designated seismic system components subject to the provisions of ASCE 7 Section 13.2.2 shall test or analyze the component and its mounting system or anchorage and submit a certificate of compliance for review and acceptance by the registered design professional responsible for the design of the designated seismic system and for approval by the building official in accordance with 2025 California Building Code (CBC), Chapter 17A "Special Inspections and Tests", Section 1705A.13 "Special Inspections for Seismic Resistance".

1.9 CONFLICTING REQUIREMENTS

- A. In case of conflict between the Drawings and the Specifications, the Drawings shall govern in matters of quantity, the Specifications in matters of quality.
- B. In case of conflict within the Drawings involving quantities or within the Specifications involving qualities, the greater quantity and higher quality shall be furnished.
- C. Should conflict appear in the Drawings or Specifications, or in the work done by others affecting this work, the Contractor shall immediately notify the Architect in writing and the Architect will issue instructions as to procedure. If the Contractor proceeds with the work so affected without instructions from the Architect, the Contractor shall make good any resulting damage or defects.
- D. In the case of conflict within the Drawings, the following shall govern:
 1. Schedules, when identified as such, shall govern over all other portions of the Drawings.
 2. Specific notes shall govern over other notes and all other portions of the Drawings except schedules described in the preceding Clause.
 3. Larger scale Drawings shall govern over smaller scale Drawings.
 - a. For Example: 1/4" = 1'-0" scale Drawings shall govern over 1/8" = 1'-0" scale Drawings.
 4. Figured or numerical dimensions shall govern over dimensions obtained by scaling.
- E. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

- F. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.10 MOCKUPS

- A. Refer to individual Sections for mockup requirements, as applicable.
- B. Tests will be performed under provisions identified in this Section and identified in respective product specification Sections.
- C. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- D. Accepted mockups shall be comparison standard for remaining Work.
- E. Where mockup has been accepted by Architect and is specified in product specification Sections to be removed; remove mockup and clear area when directed to do so by Architect.

1.11 FIELD SAMPLES

- A. Install field samples at the site as required by individual specifications Sections for review.
- B. Acceptable samples represent a quality level for the Work.
- C. Where field sample is specified in individual Sections to be removed, clear area after field sample has been accepted by Architect.

1.12 INSPECTION AND TESTING LABORATORY SERVICES

- A. Owner will select and pay for the services of an independent Inspection/Testing Laboratory to perform inspections and testing. Selection shall be subject to approval by Architect and Division of the State Architect (DSA).
 - 1. Special Inspector: As required by 2025 California Building Code (CBC) including Chapter 17A "Special Inspections and Tests".
 - a. Special Inspection: As defined in CBC Chapter 17A, Section 1704A "Special Inspections and Tests, Contractor Responsibility, and Structural Observation".
 - 2. Owner may request Architect to hire an independent Inspection/Testing Laboratory on Owner's behalf.
- B. Inspection/Testing Laboratory will perform inspections, tests, and other services specified in individual specification Sections and as required by Architect.
 - 1. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Reports will be submitted by inspection/Testing Laboratory to Owner, Architect, Contractor, Project Inspector, and DSA, indicating observations and results of tests and indicating compliance or non-compliance with the Contract Documents.

- D. Cooperate with Inspection/Testing Laboratory; furnish samples of materials, design mix, equipment, tools, storage, and assistance as requested.
 - 1. Notify Architect and Inspection/Testing Laboratory 24 hours prior to expected time for operations requiring services.
 - 2. Make arrangements with Inspection/Testing Laboratory and pay for additional samples and tests required for Contractor's use.
- E. The Inspection/Testing Laboratory shall perform inspection of work to determine conformance with these Standards.
 - 1. Request for inspection shall be made to the office of the Inspection/Testing Laboratory a minimum of 24 hours in advance of the time the inspection is desired.
 - 2. Underground work shall not be backfilled or covered until an inspection by the Inspection/Testing Laboratory has been completed and the work approved. Any work that is covered without inspection shall be uncovered at Contractor's expense, for completion of inspection work.
 - 3. The Inspection/Testing Laboratory shall have access to the Work at all times and shall be furnished every reasonable facility for ascertaining that the work done, materials used and workmanship performed are in accordance with the requirements of these Standards.
 - 4. Inspection of the Work shall not relieve Contractor of any of their obligations to satisfactorily perform the Work in accordance with requirements of Contract Documents.
- F. Retesting or reinspection required because of non-conformance to specified requirements shall be performed by the same Inspection/Testing Laboratory. Payment for retesting will be charged to Contractor by deducting inspection or testing charges from the Contract Sum.
- G. If the Work to be tested or inspected is not ready or sufficiently completed to allow the test/inspection service to complete required test(s)/inspection(s), costs, and expenses of the test/inspection service to return to the Site or fabrication facility to perform/complete required test(s)/inspection(s) shall be charged to Contractor by deducting such costs and expenses from the Contract Sum.
- H. All Samples, specimens and tests shall be prepared and accomplished by a properly qualified person or testing laboratory, selected by Owner with the approval of Architect, Structural Engineer, and DSA, who shall furnish Owner, Architect, Contractor, and DSA with test reports, including test results, and stating that they were prepared in accordance with the specified provisions. All tests as well as sampling and preparation of samples shall be in accordance with applicable ASTM and other specified standards. One copy of all test reports shall be forwarded to DSA.

1.13 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification Sections, material and product suppliers, and manufacturers shall provide qualified personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, testing, adjusting, and balancing of equipment, as applicable, and to initiate installation instructions when necessary.
- B. Submit qualifications of qualified personnel to Architect at least 15 days in advance of required observations.

- C. Qualified personnel shall report observations, site decisions, and supplemental instructions given to applicators and installers, and description of work installed contrary to manufacturers' written installation instructions, as applicable.
- D. Submit report in duplicate within 30 days of observation to Architect for review.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify and ensure that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify and ensure that existing substrate is capable of structural support and attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification Sections.
- D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION

SECTION 01 50 50
EROSION CONTROL

PART 1 GENERAL

1.1 SCOPE OF WORK

- .A The Contractor shall provide all materials, labor and equipment necessary to complete all work as specified herein, including but not limited to the following:
 - . Apply specified treatments to all cuts and fill slopes, soil stockpiles, and all disturbed areas.
 - . Install all temporary erosion control devices per Plans and Specifications.
- .B All other labor and materials reasonably incidental to the satisfactory completion of the work, including cleanup of the site.

1.2 RELATED SECTIONS

- .C Section 01 10 00, Supplemental General Requirements

1.3 RELATED DOCUMENTS

- .D Caltrans Standard Specifications, 2015
 - . Section 21, Erosion Control
- .E Association of Official Seed Analysts Procedures
- .F California State Seed Law of the Department of Food and Agriculture

1.4 CONTRACTOR SUBMITTALS

- .G The Contractor shall submit, in accordance with Section 01 10 00, Supplemental General Requirements, manufacturer's letters of compliance and manufacturer's literature for the following items:
 - . Seed Mixes (or individual items)
 - . Mulches
 - . Binders/Tackifiers
 - . Fertilizer
 - . Humate
 - . Soil inoculates
 - . Straw (Weight receipts from scales shall be required)
 - . Erosion Control Blanket

1.5 SITE CONDITION

- .H It is the responsibility of the Contractor to visit the site to determine existing conditions including access to the site, the nature and extent of existing improvements upon adjacent public and private property, the nature of materials to be encountered, and other factors that may affect the work of this section.

- .I It is the responsibility of the Contractor to have finished the grading of the slopes, including track walking the areas to be treated with erosion control treatments.

1.6 WORK SCHEDULE

- .J The Contractor shall proceed with work during a period of August 15 through October 15, 2026 or between January 15 and February 15, 2026. The work shall progress as soon as the site becomes available consistent with normal seasonal limitations.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- .K All products shall be delivered to the site in manufacturer's unopened standard containers bearing original labels showing quantity, analysis and name of manufacturer.
- .L All materials shall be stored in designated areas and in such a manner as to protect them from weather or other conditions that might damage or impair the effectiveness of the product.

1.8 ANALYSIS OF SAMPLES AND TESTS

- .M Samples: The Owner reserves the right to take and analyze samples of materials for conformity to the Specifications at any time. On request, seed shall delivered to Owner's Representative 30 days prior to seeding so seed can be tested. Seed samples shall be drawn in accordance with procedures outlined in Association of Official Seed Analysts.
- .N Rejected material: Rejected materials shall be removed immediately from the site at Contractor's expense. Contractor shall pay the cost of testing replacement materials.

PART 2 PRODUCTS

2.1 GENERAL

- .O All products shall be in conformance with the Specifications listed below. Any changes to products to be used shall be approved, in writing, by the Owner or Owner's representative prior to job site delivery.

2.2 SEED MIX [SEED MIX NEEDS TO BE PROVIDED BY LANDSCAPE CONSULTANT OR SEED COMPANY FOR THE PROJECT AREA]

- .P Seed shall conform to the provisions in Section 21-2.02F, "Seed," of the Standard Specifications. Individual seed species shall be measured and mixed in the presence of the Owner's Representative.
- .Q Seed shall be delivered to the project site in unopened separate containers with the seed tag attached. Containers without a seed tag attached will not be accepted.
- .R Composition:

Species	Common Name	PLS lbs. /acre
<i>Gazania</i>	<i>Trailing Gazania</i>	4 lbs. /acre

NON-LEGUME SEED

Botanical Name (Common Name)	Percent Germination (Minimum)	Kilograms Pure Live Seed Per Hectare

		(Slope Measurement)
Baccharis pilularis var. pilularis (Coyote Bush)	20	0.05
Artemisia californica (California Sagebrush)	25	0.5
Mimulus aurantiacus. (Sticky Monkeyflower)	25	.1
Elymus glaucus, (Blue Wildrye)	40	9
Festuca idahoensis (Idaho Festuca)	35	4
Hordium brachyantherum californicum (Meadow Barley)	40	8
Regreen	60	45.0

.S Quality

- . All seed shall be in conformance with the California State Seed Law of the Department of Food and Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. In addition, the container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained.
- . Prior to seeding at the request of the Owner, the Contractor shall provide a letter of certification, original Association of Official Seed Analysts (AOSA) seed test results, and calculations of PLS.
- . All legume seed shall be pellet-inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 pounds of inoculant per one hundred pounds of seed.

2.3 MULCH

- .T Mulch shall be 100% wood hydroseed and shall be composed of wood fiber derived from whole wood chips with no growth or germination inhibiting substances, and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water, in the proportions specified, will form a homogeneous slurry which is capable of being sprayed to form a porous mat.
- .U The fibrous mulch in its air-dry state shall contain no more than 15% by weight of water. The fiber shall have a temporary green dye and shall be accompanied by a certificate of compliance stating that the fiber conforms to these Specifications.

2.4 ORGANIC STABILIZER/TACKIFIER

- .V Stabilizer and tackifier shall be an organic substance supplied in powder form and shall be psyllium-based and packed in clearly marked bags stating the contents of each package. The California Department of Food and Agriculture shall certify the material as an Auxiliary Soil Chemical.

2.5 FERTILIZER

- .W Fertilizer shall be of commercial quality, conform to the requirements of the California Department of Food and Agriculture Code, shall have a guaranteed analysis for nitrogen,

phosphorus and potassium of 7-2-3. Products specified as slow-release shall have been tested and demonstrate a nearly linear release curve.

2.6 HUMATE

.X Humate shall be OMRI listed and contain at least 40 % Humic acid. It shall be a natural granular humic acid based material that functions as an organic chelator and microbial stimulator. Humate shall not burn plant material and shall be non-toxic and non-staining.

.Y Humate Soil Conditioner

Humic Acids (from Leonardite)	40 .00 %
Organic matter	40 .00 % - 50.00%
Carbon	50.00 % - 60.00%
Nitrogen	0.05 % - 1%
Phosphoric Acid	0.07 %
Potash	0.13 %
Sulfur	0.21 %
Magnesium	0.18 %
Calcium	0.32 %
pH	4.0
Soluble Salts	1.8

2.7 MYCORRHIZAL INOCULUM

.Z Endo (arbuscular) mycorrhizal inoculum shall be registered by the California Department of Food and Agriculture and consist of spores, mycelium and mycorrhizal root fragments in a solid carrier suitable for handling by hydro-seeding. The carrier shall be the material in which the inoculum was originally produced, and may include organic materials, vermiculite, perlite, calcined clay, or other approved materials consistent with mechanical application and with good plant growth.

.AA Each endomycorrhizal inoculum shall carry a supplier's guarantee of 80,000 propagules minimum per kilogram. The minimum propagule count shall be shown on each label provided. If more than one fungal species is claimed by the supplier, the label shall include a guarantee for each species of mycorrhizal fungus claimed.

.BB Endomycorrhizal fungal species shall be suitable for the pH of the soil at the planting site. If the inoculum consists of a mixture of species, no more than 20% of the claimed propagule count shall consist of fungal species known to be unsuitable for the pH of the soil at the planting site.

.CC A sample of approximately 28 grams (one ounce) of inoculum will be taken from each inoculum container by the Owner's Representative. The number of propagules will be determined by laboratory testing. Propagules shall include live spores, mycelial fragments and viable mycorrhizal root fragments.

.DD Endomycorrhizal inoculum shall be stored, transported and applied at temperatures of less than 32° C (90° F).

2.8 STRAW

.EE Shall be derived from irrigated rice or clean cereal grain straw.

.FF The Contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw from outside the County in which it is to be used is delivered to the site of the work.

.GG Straw that has been used for bedding is prohibited.

2.9 EQUIPMENT

.HH Equipment used for application of slurry shall be a commercial-type Hydro-Seeder and have a built-in agitation system with an operation capacity sufficient to agitate, suspend and homogeneously mix slurry.

.II Tank capacity shall be a minimum of 1,500 gallons and shall be mounted on a truck to allow access to the site.

.JJ Pump shall be able to generate 150 psi at the nozzle.

.KK Straw blowers: Equipment shall be specifically designed and manufactured for the application of straw and shall be of sufficient horsepower to break up and distribute straw at the specified application rate.

2.10 WATER

.LL Water shall be furnished by Owner and shall be made readily available at the sites indicated on the project map. Water shall be of potable quality.

.MM Contractor shall add 4-6 lbs. of Vulpia Microstachys or 20 lbs. of Regreen per acre if hydroseeding occurs in the fall or winter months.

.NN Hydroseed mix can be obtained from Pacific Coast Seed, Inc., (925) 373-4417.

1.01 EROSION CONTROL BLANKETS

.OO Erosion control must be Erosion Control Technology Council (ECTC) Type 2D and made of processed natural fibers that are mechanically, structurally, or chemically bound together to form a continuous matrix that is surrounded by 2 natural nets. Erosion control blanket must comply with the requirements shown in the following table:

Erosion Control Blanket				
Quality characteristic	Test method	Requirement		
		Type A	Type B	Type C
Roll width (min, inches)	--	72		
Matrix (%)				
Straw/coconut		70/30	--	--
Woven coir (coconut fiber)	--	--	100	--
Wood excelsior (6 inches or longer)		--	--	80
USLE C-Factor for a 1:1 (H:V) unvegetated slope	--	≤ 0.20		

Shear stress (max, psf)	ASTM D6460	1.75
Tensile strength (min, psf)	ASTM D5035	75
Functional longevity (months)	--	12

PART 3 EXECUTION

3.1 SOIL PREPARATION

.PPNo soil amendments shall be required except as noted on the Plans.

.QQ Verification: Contractor shall verify:

- . That all areas to receive erosion control treatments are free of vegetation and other objectionable material.
- . That grades are final for permanently treated areas and within reasonable standard for temporary treatments.
- . That all sloped areas are uniformly compacted: wherever possible, the surface compaction of the top 1 foot shall be 85% or less.

3.2 EROSION CONTROL BLANKET INSTALLATION

.RR Before placing the erosion control blankets, Contractor shall ensure the subgrade has been graded smooth and has no depressed voids. The subgrade must be free from obstructions, such as tree roots, projecting stones, or foreign matter greater than 1 inch in diameter. Overlap the end of the erosion control blanket by 24 inches. Use 18 inch staples staked at maximum of 4 feet on center in staggered pattern. Do not drive vehicles on the erosion control blanket.

3.3 HYDROSEEDED AREA

.SSAreas to receive erosion control treatments include all graded areas as shown on the site plan and other areas as determined by the Owner.

.TTPerform erosion control treatments on a section by section basis. On approval of the Owner, and as soon as possible after grading, complete treatments in the following order of priority: stream zones, graded slopes, non-trafficked road and parking areas, building pads and other flat areas.

.UU Contractor shall be available to re-treat areas disturbed by on-going activities.

.VVPreparation: All slurry preparation to be conducted at the job site.

- . Water, mulch, fertilizer, compost, binder and other ingredients shall be added to the tank simultaneously so that the finished load is a homogenous mix of the specified ingredients.
- . Seed shall be added last and shall be discharged within 2 hours. Loads held over 2 hours will be recharged with ½ the seed rate before application.
- . Once fully loaded, the complete slurry shall be agitated for 3-5 minutes to allow for uniform mixing.

.WW Application: Apply specified slurry in a sweeping motion to form a uniform application.

- . Step One - with hydroseeder apply:
 - . Seed Mix Total 4 lbs./acre
 - . 100% Cellulose Fiber Mulch 500 lbs./acre
 - . Biosol 7-2-3 (Organic Fertilizer) 1,600 lbs./acre
 - . AM120 (Mycorrhizal Inoculant) 60 lbs./acre
- . Step Two - with straw blower apply:
 - . Rice or Clean Cereal Grain Straw 4,000 lbs./acre
- . Step Three - with hydroseeder apply:
 - . 100% Cellulose Fiber Mulch 500 lbs./acre
 - . M-Binder 100 lbs./acre
- . Under suitable conditions straw shall be uniformly spread at the specified rates. The straw may be pneumatically applied as long as the resulting straw is predominately 3 to 6 inches in length. The straw shall be treated with mulch and tackifier before it can blow off the site but in no case shall straw be left untreated for more than 24 hours. The Contractor will clean up areas of straw which are blown from the site, and the areas shall be retreated at no additional expense to the Owner.

.XXProtection: Contractor is to stay off treated areas.

.YYUnused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at Contractor's expense.

.ZZPreliminary Inspection: Notify the Owner's Representative 48 hours in advance of all seeding. Inspection and favorable review of completed work shall begin the plant establishment period.

3.4 PLANT ESTABLISHMENT MAINTENANCE

.AAA General plant maintenance shall immediately follow seeding and continue for **90 days**.

.BBB Protect areas against all damage, including erosion and trespass, and provide proper safeguards. Maintain and keep in good repair all temporary barriers erected to prevent trespassing. Check all barrier and temporary fencing daily, and make immediate repairs or replacements

.CCC Repair all damage to seeded areas.

.DDD Maintain constant moisture depth in soil to insure vigorous growth.

3.5 FINAL INSPECTION AND ACCEPTANCE:

.EEE Final inspection will be conducted upon completion of maintenance, replacements and corrective work. Five (5) days' notice shall be given. If project improvements, corrective work, and maintenance have not been performed as specified and to the satisfaction of the Owner's Representative, maintenance shall continue at Contractor's expense until such time as work has been successfully completed.

3.6 GUARANTEE AND REPLACEMENT

.FFF Guarantee all planting to be in a healthy, thriving condition until the end of the maintenance period or beyond that time until active growth is evident and for one year from date of acceptance.

.GGG Replace all seeded areas not in vigorous condition as soon as directed by Owner's Representative. Seed mixture used for replacement must be of the same kind and quantity as specified in this section.

3.7 CLEAN-UP

.HHH Erosion control work areas shall be maintained in a neat and orderly condition. Keep paved area free of erosion treatment, soil, and other debris.

.III Overspray: Installing Contractor is responsible for washing or otherwise cleaning excess material off all areas not intended to receive treatment.

.JJJ Debris: Clean up and remove erosion control associated materials and debris from project site before Final Acceptance.

END OF SECTION

SECTION 01 57 23

STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Prevention of storm water pollution during construction to comply with state and federal regulations.
- B. Permit violation responsibilities and compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.2 RELATED REQUIREMENTS

- A. Section 01 57 13 – Temporary Erosion and Sediment Control

1.3 REFERENCE STANDARDS

- A. SWRCB Construction General Permit (CGP) - California State Water Resources Control Board (SWRCB) Construction General Permit (CGP) Order No. 2022-0057-DWQ; 2022.

1.4 SUMMARY

- A. Construction, demolition, or other activities causing land disturbance, including but not limited to, clearing, grubbing, grading, stockpiling, and excavation, are subject to the SWRCB Construction General Permit (CGP).
- B. To comply with State and Federal regulations on construction storm water management and urban runoff pollution control, ensure no pollutants enter the storm drain system.
- C. The Owner's Representatives will prepare a site-specific Storm Water Pollution Prevention Plan (SWPPP) and file the Notice of Intent (NOI) on behalf of the Owner.
- D. Implement and monitor the Storm Water Pollution Prevention Plan, and file permit required reports in accordance with the SWRCB Construction General Permit (CGP):
 - 1. Provide a Qualified SWPPP Practitioner (QSP) for monitoring and implementation.
 - 2. Implement the site-specific Storm Water Pollution Prevention Plan (SWPPP).
 - 3. Install measures to prevent erosion.
 - 4. Manage construction materials.
 - 5. Maintain the current revised SWPPP at the Contractor's work site.
 - 6. File reports required by the Permit and make available upon request.
 - 7. File the Notice of Termination (NOT) in a timely manner upon completion.
- E. All Construction General Permit requirements remain in effect until Notice of Termination approval.

1.5 DEFINITIONS

- A. LRP: Legally Responsible Person, a representative of the permittee and signatory that is legally designated to sign, certify, and electronically submit documents required by the Permit.

- B. DAR: Duly Authorized Representative, an individual who has been given authority by the LRP to act on their behalf within SMARTS.
- C. Data Submitter: an individual authorized by the LRP or DAR to enter data in SMARTS on behalf of the LRP.
- D. PRD: Permit Registration Document, required document that must be submitted to obtain coverage under the Construction General Permit.
- E. QSD: Qualified SWPPP Developer, a certified person responsible for preparing, amending, and certifying the project SWPPP, as well as inspecting and documenting SWPPP compliance.
- F. QSP: Qualified SWPPP Practitioner, a certified person responsible for non-storm water and storm water visual observations, sampling and analysis, and for ensuring full compliance with the Construction General Permit and implementation of all elements of the SWPPP.
- G. SWRCB: State Water Resources Control Board is the State of California's State Water Board, responsible for overseeing the permitting process for the SWPPP.
- H. SMARTS: Storm Water Multiple Application and Report Tracking System, SWRCB's platform for managing and submitting PRDs, compliance information, and monitoring data in association with the Construction General Permit:
<https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.xhtml>
- I. SWPPP: Storm Water Pollution Prevention Plan, to be developed and certified by a QSD and to be implemented by a QSP.
- J. Storm Drain System: Network of infrastructure to collect and transport rainwater. This includes, but is not limited to, inlets, storm water conduits, storm drain structures, street gutters, channels, and ditches.

1.6 PERFORMANCE REQUIREMENTS

- A. Follow, implement, and execute all provisions of the State Water Resources Control Board Construction General Permit for Storm Water Discharges on the behalf of the Owner, and include all associated costs within the bid.
- B. The Owner's Representatives will provide a Qualified SWPPP Developer (QSD) to prepare the following documents in accordance with the SWRCB Construction General Permit (CGP) and submit them to SMARTS:
 - 1. Storm Water Pollution Prevention Plan (SWPPP)
 - 2. Permit Registration Documents (PRDs)
 - 3. SWPPP amendment documents
- C. The Owner will certify the Notice of Intent (NOI) application, SWPPP, other Permit Registration Documents, and SWPPP amendment documents on SMARTS, as well as pay the fee to complete the NOI application, for review by the SWRCB.
- D. Provide a Qualified SWPPP Practitioner (QSP) to implement the SWPPP, including maintaining SWPPP measures, conducting regular site inspections, collecting and inputting data, taking corrective action, and preparing required reports, in accordance with the SWRCB Construction General Permit (CGP). The QSP must meet the Construction General Permit certification requirements.

- E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until the SWRCB notifies the owner that the Notice of Intent (NOI) application is active, and a Waste Discharge Identification (WDID) number is issued.
- F. Keep the project SWPPP accessible at the construction job site during working hours and provide it upon request by the Owner or State Inspector.
- G. Furnish, place, and install effective measures for preventing runoff of soil, silts, gravel, hazardous chemicals or other materials prohibited by the Regional Water Quality Control Board (RWQCB) from entering the storm drain system in accordance with the Storm Water Pollution Prevention Plan (SWPPP).
- H. Manage on-site construction materials to prevent contact with storm water or wash water and prevent run-off into the storm drain system.
- I. Monitor and inspect the site in accordance with the Construction General Permit and implement corrective actions to address deficiencies.
 - 1. Visually inspect stormwater discharges, dewatering discharges, authorized non-stormwater discharges, and unauthorized non-stormwater discharges.
 - 2. Sample and monitor non-visible pollutants and any applicable TMDLs as required.
 - 3. Monitor effluent water quality as required by the Construction General permit.
- J. Maintain a rain gauge at the site and record daily rainfall amounts when the site is open until Notice of Termination approval.
- K. Notify the Owner if the QSP is no longer associated with the work and provide a qualified replacement within twenty-four (24) hours. A QSP must be maintained from the beginning of the project until the Notice of Termination is approved.

1.7 SUBMITTALS

- A. Submittal Notation: Submittal documents to include specification number and title, and description of item of work covered.
- B. Reports required by Construction General Permit
 - 1. Prepare and make available upon request.
 - 2. These include, but are not limited to:
 - a. Inspection reports
 - b. Annual Reports
 - c. Ad Hoc Reports
 - d. Corrective Action Reports
 - e. Numeric Action Level Exceedance Reports
 - 3. Submit Reports to SMARTS in PDF format in accordance with Construction General Permit requirements.
 - a. Inspection reports not required for submittal unless requested by the SWRCB.
 - b. Annual Reports required yearly prior to September 1.
- C. Notice of Termination (NOT)
 - 1. Ensure that the QSP submits the Notice of Termination to SMARTS in PDF format, in

accordance with Construction General Permit requirements.

2. NOT Attachments – upload photographs and required supporting documents:
 - a. Final site map
 - b. QSP final inspection
 - c. Approved Storm Water Control Plan (SWCP) or post-construction water balance data as applies
 - d. Signed Operations and Maintenance Manual (O&M)
 - e. Additional requested Agency requirements
3. Notify the Owner when documents are ready for Owner certification in SMARTS.

1.8 PERMIT VIOLATIONS

- A. If there is a Permit violation, notify the Owner immediately and make necessary corrections to comply with the Construction General Permit at no cost to the Owner.
- B. The Contractor is responsible for fines, or fees from additional sampling, testing and monitoring, that result from non-compliance with the Construction General Permit requirements, without compensation from the Owner. If the Owner incurs fines or fees from the SWRCB due to the Contractor's failure to comply with the Construction General Permit requirements, the costs will be deducted from the Contractor's contract value.
- C. If the Regional Water Quality Board is at the site, notify the Owner within twenty-four (24) hours and provide a written notice of deficiencies noted and/or changes requested by the inspector.
- D. Violation of the Construction General Permit may cause the Owner to issue a stop-work notice. All costs related to the stop-work action are at the sole expense of the Contractor.

PART 2 PRODUCTS

2.1 PRODUCTS AND MATERIALS

- A. Use products and materials identified in the approved Storm Water Pollution Prevention Plan (SWPPP), Erosion Control Plan, and Section 01 57 13, as determined by the QSP.

PART 3 EXECUTION

3.1 EXECUTION AND IMPLEMENTATION

- A. The QSP is responsible for executing and implementing this work in accordance with the approved Storm Water Pollution Prevention Plan (SWPPP), Erosion Control Plan, and Section 01 57 13.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Products.
- B. Product Delivery Requirements.
- C. Product Storage and Handling Requirements.
- D. Product Options.
- E. Product Substitution Procedures.

1.2 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components required for reuse.
- B. All products shall be new, of first class quality, and shall be delivered, installed, connected and finished in every detail, and shall be so selected and arranged as to fit correctly into the proper spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by Architect shall be furnished. Contractor shall provide satisfactory evidence as to the kinds and quality of material and workmanship.
- C. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- D. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with Manufacturer's written installation instructions.
- B. Delivery of materials to the project site shall be coordinated by and received by Contractor or their representative, and stored in secured areas as agreed upon at the job start meeting.
- C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.
- D. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.
- E. Contractor shall take into consideration the available space and location of work site when delivery of materials is necessary.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with Manufacturer's written installation instructions, with seals and labels intact and legible. Store sensitive products in weathertight, climate controlled, enclosures in an environment favorable to product.
- B. For exterior storage of fabricated products, place on sloped supports above ground.
- C. Provide off-site storage and protection when site does not permit on-site storage or protection.
- D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation and degradation of products.
- 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 assure products are undamaged and are maintained under specified conditions.
- H. Contractor shall be responsible to provide all new materials in unopened manufacturer's original containers and deliver such items to project site in good condition for use on this project. Contractor shall be responsible to store all new materials received as per manufacturer recommendations. Any and all materials discovered to be improperly stored and/or damaged will be replaced at the sole expense to Contractor. Any requests for delays or extension of the Contract Time due to the above will not be considered.
- I. Contractor shall use all means necessary to protect all materials before, during, and after installation and to protect the installed work and materials of all other trades and of existing structures. In event of damage, Contractor is to immediately make all repairs and replacements necessary using compatible and like materials.

1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One Manufacturer and Stating No Substitutions Allowed, Owner's Standard: Products of manufacturer named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers Without Naming a Product, With a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- D. Products Specified by Naming One or More Manufacturers and Naming Product(s) by the First Listed Manufacturer, With a Provision for Substitutions: Submit a request for substitution for any product, by any manufacturer, listed or not listed, other than the product(s) listed.

- E. Basis of Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words Basis of Design, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other manufacturers, whether listed or not. Submit a substitution request for any product, by any manufacturer, listed or not listed, other than the product(s) listed as Basis of Design.

1.6 PRODUCT SUBSTITUTION PROCEDURES

- A. Architect will consider requests for Substitutions only within 35 days after Award of the Contract.
- B. Reference to any product, material, equipment, article, system, service or patented process, by trade, catalogue number, name brand product, or product manufacturer is for information only and shall not be construed as limiting competition.
- C. Substitutions will only be considered when one or more of the following conditions are met:
 - 1. All aspects of the proposed substitution meet or exceed the criteria for the specified product.
 - 2. The proposed changes are in keeping with the general intent of the Contract Documents.
 - 3. The request is fully documented and timely and properly submitted.
 - 4. The specified product cannot be provided within the Contract Time.
 - 5. The request is directly related to an or equal clause or similar language in the Contract Documents.
 - 6. The request offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities that Owner must assume. Owner's additional responsibilities may include, but not be limited to, compensation to Architect for redesign and/or evaluation services and increased cost of other construction by Owner.
 - 7. The specified product becomes unavailable through no fault of Contractor.
 - 8. The specified product cannot receive necessary approvals by governing authorities, and the requested substitution can be approved by governing authorities in a timely manner.
 - 9. It can be demonstrated that the specified product cannot be provided in a manner that is compatible with other materials and Contractor certifies that the proposed substitution will overcome the incompatibility.
 - 10. It can be demonstrated that the specified product cannot be coordinated with other materials and Contractor certifies that the proposed substitution can be coordinated.
 - 11. The specified product cannot provide the warranty required by the Contract Documents and Contractor certifies that the proposed substitution provides the required warranty.
- D. Substitutions will not be considered when one or more of the following conditions occur:
 - 1. Acceptance would require revisions to the Contract Documents, Contract Time extensions, or an increase in the Contract Sum.
 - 2. They are indicated or implied on shop drawing or product data submittals, without separate written request.

3. When the specified product cannot be provided as a result of failure of Contractor to pursue the Work in a timely manner or properly coordinate construction activities.
- E. In those cases where the Specifications designate a product, material, equipment, article, system, service or patented process by specific brand or trade name and there is only one brand or trade name listed, the item involved is:
1. Required to be used since it is a unique or novel product application, or
 2. Required to match other products in use by Owner, or
 3. Is the only brand or trade name known to Architect.
- F. Document each request on Substitution Request Form attached at the end of this Section with complete data substantiating compliance of proposed Substitution with the Contract Documents. The burden of proof as to comparative quality, suitability and performance of proposed product(s), material(s), equipment, article(s), system(s), service(s) or patented process(es) shall be upon Contractor. Architect will be the sole judge of the equality of the proposed substitution versus the specified item(s).
- G. A substitution request constitutes a representation that Contractor:
1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same or better warranty for the Substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extensions which may subsequently become apparent.
 5. Will reimburse Owner for review services associated with approvals by authorities having jurisdiction.
- H. Substitution Submittal Procedure:
1. Submit request for Substitution electronically. Limit each request to one proposed Substitution.
 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
 3. Architect will notify Contractor, in writing, of decision to accept or reject request.
 4. Incomplete Substitution Request package will not be reviewed and will be returned to Contractor. Contractor shall then provide the specified item.
 5. Only one request for substitution will be allowed. If proposed substitution is not accepted by Architect, Contractor shall provide the specified item.
 6. Use of accepted substitutions shall in no way relieve Contractor from responsibility for compliance with Drawings and Specifications.
 7. All costs associated with accepted substitutions shall be borne by Contractor including, but not limited to, required changes to the Project's design, architectural and/or engineering design fees, detailing, Agency approvals and fees, and all additional construction costs caused by substitution.
 8. All substitutions affecting structural or fire/life safety items will require approval from DSA prior to fabrication and installation on the project.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials furnished shall be new and never been used before, unless specified otherwise, and will satisfy the requirements herein and all specifications referenced by provisions within these specifications. Contractor shall furnish, upon request of Architect, an affidavit from the manufacturer or supplier to the effect that materials furnished shall conform to the General Conditions, the latest revision of AWWA Specifications, ASTM, and Federal Specifications that pertain. All materials shall be installed in accordance with manufacturer's recommendations and the Standard Drawings and Specifications that pertain. Material for one specific product shall be one manufacturer unless otherwise approved by Architect. All materials shall be subject to inspection after delivery to the site and during installation of the work. Failure of the Inspector or Architect to note faulty material shall not relieve Contractor of the responsibility for removing or replacing any such material at no additional cost to Owner.
- B. For the ease of maintenance and parts replacement, to the maximum extent possible use materials of a single manufacturer, delivered in manufacturer's original, unopened containers with labels intact and legible, and in sufficient quantity to allow continuity of work. Deviation from this requirement shall require written approval from Owner and Architect.
- C. Architect reserves the right to reject any materials list which contains materials from various manufacturers if suitable materials can be secured from fewer manufacturers and to require that source of materials be unified to maximum extent possible.

PART 3 EXECUTION

Not Used

END OF SECTION

SUBSTITUTION REQUEST FORM

SUBSTITUTION REQUEST NUMBER: _____

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Section	Page	Paragraph	Description

The undersigned requests consideration of the following:

Proposed Substitution (Manufacturer, Model # or Name, Color, Etc.): _____

History: ☐ New Product, ☐ Available 2-5 Years, ☐ Available 6-10 Years, ☐ Available 10+ Years

Provide UL, ITS, WHI, (or other) listing / rating of proposed substitution: _____

Attached data shall include, but not be limited to, product, specification, drawings, performance and test data adequate for evaluation of the request for the proposed substitution product and the specified product, with applicable portions of the proposed substitution and the specified product data clearly identified in a point-by-point direct comparison chart. Incomplete form and attachments will result in rejection of substitution request.

Requestor shall address the following items on this Substitution Request Form. Use a separate attached sheet attached as needed:

1. Reason for not providing specified item:

2. Will proposed substitution affect dimensions indicated on Drawings? ☐ (Yes) ☐ (No)

If yes, how? _____

3. Will proposed substitution affect Electrical, Mechanical, Structural, Architectural, etc.?

☐ (Yes) ☐ (No) If yes, explain:

4. Is proposed substitution larger or smaller than specified product? ☐ (Yes) ☐ (No)

If yes, state size of substitute product:

5. Does proposed substitution weight less/more than specified product? ☐ (Yes) ☐ (No)
If yes, state weight of substitute product:

6. Will proposed substitution affect other trades and/or parts of the work? ☐ (Yes) ☐ (No)
If yes, explain all effects:

7. Comparison between proposed substitution and specified product (Similarities / Differences)?

8. If Substitution Request is accepted, Owner will receive a credit of \$ _____. The Contract Sum will be adjusted accordingly.
9. Will proposed substitution affect the Contract Time? ☐ (Yes) ☐ (No)
If yes, (Add) (Deduct) _____ calendar days.
- _____

INITIAL

UNDERSIGNED CERTIFIES:

- _____ Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- _____ Proposed substitution has same or better warranty as specified product.
- _____ Proposed substitution has same or better maintenance service and availability of replacement parts as specified product.
- _____ Proposed substitution will not affect or delay the Construction Schedule.
- _____ Claims for additional costs related to accepted substitution, which may subsequently become apparent, are hereby waived.
- _____ Proposed substitution will not affect dimensions and functional clearances.
- _____ Coordination, installation, and changes in the Work as necessary for installation of accepted substitution will be complete in all respects, at no additional cost to Owner.
- _____ Contractor will pay for all costs associated with changes to the project's design, including, but not limited to, architectural or engineering design fees, detailing, Agency approvals and construction costs caused by the requested substitution.
- _____ The function, appearance and quality of the proposed substitution is equivalent or superior to the specified item.

The undersigned certifies that the above is accurate and correct.

Signature: _____

Company: _____

Address: _____

Date: _____

Telephone: _____

Attachments: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ Other (Describe)

Architect's Review and Action:

_____ Substitution Accepted – Make submittals in accordance with Specification Division 01.

_____ Substitution Accepted as Noted - Make submittals in accordance with
Specification Division 01.

_____ Substitution Rejected – Provide specified product.

_____ Substitution Request Received Too Late – Provide specified product.

By: _____ Date: _____

Remarks: _____

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Starting of systems.
- D. Demonstration and instructions.
- E. Protecting installed construction.
- F. Project record documents.
- G. Operation and maintenance data.
- H. Manual for materials and finishes.
- I. Manual for equipment and systems.
- J. Spare parts and maintenance products.
- K. Extra materials.
- L. Product warranties and product bonds.
- M. Maintenance service.

1.2 RELATED SECTIONS

- A. Section 01 33 00 – Submittal Procedures.

1.3 CLOSEOUT PROCEDURES

- A. Submit written certification that the Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with the Contract Documents and ready for Architect's review.
- B. Provide submittals to Architect and Owner required by DSA.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- D. The submission, by Contractor, of satisfactory evidence that no claim or lien exists against Contractor for labor done or materials furnished under the Contract.
- E. The submission, by Contractor to Architect of the completed and executed DSA Final Verified Reports.
- F. Submit items to Architect or other parties as required by individual sections of the Specifications.

1.4 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- D. Replace filters of operating equipment affected by start-up procedures.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from the site.
- H. Contractor shall be responsible for restoring the work area and all auxiliary areas utilized during the work to conditions that are equal to or better than existed prior to project commencement. Any damages to interior or exterior building surfaces, walkways, landscaping, utilities, etc., shall be repaired or replaced at the sole expense to Contractor.
- I. After completion and final acceptance of the project, Contractor shall immediately remove all equipment, fencing, construction materials, and debris from project site.

1.5 STARTING OF SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner 7 days prior to start-up of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative or Contractors' personnel in accordance with Manufacturer's written installation instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

1.6 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel 2 weeks prior to date of final inspection.

- B. Demonstrate Project equipment instructed by qualified manufacturer's representative who is knowledgeable about the Project.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within 6 months.
- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at designated location.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.7 TESTING, ADJUSTING, AND BALANCING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Owner will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing.
- C. Reports will be submitted by independent firm to Contractor, Architect, and Owner indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.8 PROTECTING INSTALLED CONSTRUCTION

- 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 prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, 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. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.9 PROJECT RECORD DOCUMENTS

- A. Maintain on site, 1 set of the following record documents; record actual revisions to the Work:
 - 1. Contract Drawings, all divisions and trades.
 - 2. Specifications.
 - 3. Addenda.

4. Change Orders, Construction Change Documents, and other modifications to the Contract.
 5. Reviewed and accepted shop drawings, product data, and samples.
 6. Manufacturer's written instructions for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product Section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
 2. Product substitutions or alternates utilized.
 3. Changes made by Addenda and other modifications to the Contract.
- F. 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.
 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 4. Field changes of dimension and detail.
 5. Details not on the original Contract Drawings.
 6. All changes and clarifications as a result of Change Orders, Requests for Information, Construction Change Directives, and Architect's Supplemental Instructions.
- G. Contractor shall keep the progress Project Record Documents current. In the event that these documents are not kept current, a portion of the monies due Contractor will be withheld from each Application for Payment until the Project Record Documents are brought up to current status, to the satisfaction of Architect.
- H. Submit Project Record Documents to Architect with claim for final Application for Payment.

1.10 OPERATION AND MAINTENANCE DATA

- A. Submit complete operation and maintenance information in digital format for all manufactured materials and equipment installed on the Project prior to final inspection.
- B. Prepare digital manual with title OPERATION AND MAINTENANCE INSTRUCTIONS, and title of Project.
- C. Internally bookmark the digital manual, logically organized, and titled as described below.
- D. Contents: Prepare a Table of Contents for digital manual, with each product or system description identified, in 3 parts as follows:
 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Written operating instructions.
 - e. Written maintenance instructions for equipment and systems.
 - f. Written maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Certificates.
 - c. Photocopies of warranties and bonds.
- E. Submit Digital Operation and Maintenance Data in final form 15 days prior to final inspection for Architect review and comment. Revise content of documents as required prior to final submittal.
- F. Submit final Digital Operation and Maintenance Data within 10 days after final inspection.

1.11 MANUAL FOR MATERIALS AND FINISHES

- A. Submit digital copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review and provide comments on digital preliminary draft.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.
- C. Submit digital copy of completed manual 15 days prior to final inspection. Draft digital copy will be reviewed and returned with Architect comments. Revise content of document sets as required prior to final submission.
- D. Submit revised final manual within 10 days after final inspection.
- E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition and color, and texture designations. Include information for re-ordering custom manufactured products.
- F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- H. Additional Requirements: As specified in individual product specification Sections.

1.12 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit digital copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review and provide comments on digital preliminary draft.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.
- C. Submit digital copy of completed manual 15 days prior to final inspection. Draft digital copy will be reviewed and returned with Architect comments. Revise content of document sets as required prior to final submission.
- D. Submit revised final manual within 10 days after final inspection.
- E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions, and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
- G. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- H. Include servicing and lubrication schedule, and list of lubricants required.
- I. Include Manufacturer's written operation and maintenance instructions.
- J. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- L. Additional Requirements: As specified in individual product specification Sections.

1.13 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification Sections.
- B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.14 EXTRA MATERIALS

- A. Where extra materials are required by individual Sections, the quantities of materials specified shall be delivered to the location designated by the Owner. Extra materials are property of the Owner and shall not be used by the Contractor for any reason.

1.15 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within 10 days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form and contain full information.
- D. Co-execute submittals when required.
- E. Include Table of Contents and assemble in digital format.
- F. Submit prior to final Application for Payment.
- G. Time Of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Project Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Project Completion, submit within 10 days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.16 MAINTENANCE SERVICE

- A. Unless indicated otherwise, furnish service and maintenance of components indicated in specification Sections for 1 year from date of Project Completion.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
- D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedural requirements and limitations for cutting and patching work.
- B. Patching of existing materials and construction disturbed by Work under this Contract, including repair of damage to existing materials and construction caused by:
 - 1. Installation of new products, materials, and equipment or systems.
 - 2. Relocation or reinstallation of existing products, materials, and equipment or systems.

1.2 RELATED SECTIONS

- A. Section 01 33 00 – Submittal Procedures.
- B. Section 01 35 16 – Alteration Project Procedures: Cutting and patching for alterations work.
- C. Section 01 60 00 – Product Requirements: Product options and substitutions.
- D. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work, including the following:
 - 1. Cutting and patching incidental to work of the individual Section.
 - 2. Advance notification to other Sections of openings required in work of those Sections.
 - 3. Limitations on cutting structural members.

1.3 SUBMITTALS

- A. Submit written request in advance of cutting or patching which affects:
 - 1. Integrity of moisture resistant, water resistant, and exposed to weather elements.
 - 2. Utility services and mechanical/electrical systems.
 - 3. Operational elements.
 - 4. Visual qualities of sight exposed elements.
 - 5. Existing structural elements.
 - 6. Efficiency, maintenance, or safety of element.
 - 7. Work of Owner or separate contractor.
- B. Include in request:
 - 1. Identification of Project.
 - 2. Location and description of affected Work.
 - 3. Necessity for cutting or patching.
 - 4. Description of proposed Work and products to be used.
 - 5. Alternatives to cutting and patching.
 - 6. List of services and systems that will be temporarily out of service and length of disruption.

7. List of services and systems that will be relocated.
8. Reinforcement to structural elements, with details and engineering calculations showing integration of reinforcement with original structure.
9. Effect on work of Owner or separate contractor.
10. Written permission of affected separate contractor.
11. Date and time the work will be executed.

C. Architect's, Owner's, and DSA's Approval: Obtain approval of cutting and patching submittals before commencing cutting and patching work. Approval does not waive the right to require removal and replacement of unsatisfactory work.

1.4 DEFINITIONS

- A. Cutting: Removal of in-place construction for installation or performance of other Work.
- B. Patching: Repair work required for restoration of damaged surfaces to original condition after installation of other Work.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or results in increased maintenance or decreased operational life or safety.
- C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching work, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

- A. Existing Applicable Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by appropriate methods and with suitable materials so that existing applicable warranties are not voided.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Primary Products: Those required for original installation.
- B. Product Substitution: For any proposed change in materials, submit request for substitution as specified in Section 01 60 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

- B. After uncovering existing work, assess conditions affecting performance of Work.
- C. Beginning of cutting or patching means acceptance of existing conditions.
- D. Identify hazardous substances or conditions exposed during the Work to Architect for decision or remedy.

3.2 PREPARATION

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

3.3 CUTTING

- A. Execute cutting and fitting to complete the Work.
- B. Uncover in-place Work to reinstall improperly sequenced Work.
- C. Remove and replace defective or non-conforming Work.
- D. Obtain material samples of installed Work for testing, when requested.
- E. Provide openings in the Work for penetration of mechanical and electrical work.
- F. Employ experienced installer to perform cutting of moisture resistant, water resistant, exposed to weather elements, and surfaces exposed to view.
- G. Cut rigid materials in straight, true, and parallel, or perpendicular lines.
- H. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- I. Cut masonry and concrete materials using masonry saw or core drill.
- J. Pneumatic tools are not allowed without prior approval from Architect and Owner.
- K. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- L. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.

3.4 PATCHING

- A. Execute patching to complement adjacent Work.
- B. Fit products together to integrate with other Work.
- C. Execute Work by appropriate methods to avoid damage to other Work and to provide surfaces suitable for patching and finishing.

- D. Employ experienced installer to perform patching of moisture resistant, water resistant, exposed to weather elements, and surfaces exposed to view.
- E. Restore Work with new materials and products in accordance with requirements of the Contract Documents.
- F. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- H. Refinish surfaces to match adjacent finish in all respects (type, texture, thickness, color, etc.). For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.5 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Special requirements for waste management during demolition and construction operations.
 - 1. Salvaging nonhazardous waste.
 - 2. Recycling nonhazardous waste.
 - 3. Disposing of nonhazardous waste.
- B. Environmental protection requirements, both on-site and off-site, during demolition and construction operations.

1.2 WASTE REDUCTION GOALS

- A. Develop and implement a construction and demolition waste management plan.
- B. Minimize the amount of construction waste generated. The project goal is to recycle, salvage, or reuse at least 65 percent of the waste generated that may otherwise be disposed in a solid waste disposal facility (landfill), or meet a local construction and demolition waste management ordinance, whichever is more stringent, in accordance with Title 24, Part 11, Section 5.408.1.
 - 1. The combined weight of new construction disposal that does not exceed 2 pounds per square foot of building area may be deemed to meet the 65 percent minimum requirement as approved by the enforcing agency.
- C. Divert waste generated by construction and demolition activities from disposal through reuse (salvage) and recycling.
- D. Reduce waste generated using effective construction resource management practices in materials estimating, ordering, shipping, storage, installation, and disposal.
- E. Manage construction waste using best management practices to prevent contacting, contaminating, and polluting storm water run-off.

1.3 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified in this Section.
- B. CIWMB: California Integrated Waste Management Board.
- C. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial wastes, including construction, remodeling, repair, and demolition operations.
- D. Construction Waste: As defined in Title 14, CCR, Section 17225.15. Includes waste building materials, packaging and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings, and other structures.

- E. Construction and Demolition (C&D) Waste: Solid waste that is a portion of the construction waste stream and are source separated or separated for reuse solid waste and recyclable materials, including commingled and separated materials resulting from construction work that are not hazardous, and contains no more than 1 percent putrescible waste by volume.
- F. Conversion Rate: The rate set forth in the standardized Conversion Rate Table (see table at end of this Section) for use in estimating the volume or weight of materials identified in the Construction Waste Management Plan.
- G. Divert: To use material for any purpose other than disposal in a landfill or transformation facility.
- H. EA: Enforcement Agency as defined by California Public Resources Code (PRC) Section 40130.
- I. Environmental Pollution and Damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
- J. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation, or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261 and Title 22 CCR, Section 66261.3 et seq. Hazardous materials include pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- K. Hazardous Waste: As defined in 40 CFR 261 and Title 22 CCR, Section 66261.3 et seq.
- L. Putrescible Waste: Solid waste capable of being decomposed by micro-organisms with sufficient rapidity as to cause nuisance because of odors, vectors (insects, rodents, or any other animal capable of transmitting causative agents of human disease), gasses, or other offensive conditions, and include materials such as, but not limited to food wastes, offal, and dead animals.
- M. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- N. Recycle: To remove a waste material from the Project site to another site for remanufacture into a new product for reuse by others.
- O. Recycling: The process of sorting, cleaning, treating, and reconstituting materials for the purpose of using the material in the manufacture of a new product. Can be conducted on-site (as in the grinding of concrete and reuse on-site).
- P. Recycling Facility: An operation that can legally accept materials for the purpose of processing materials into an altered form for the manufacture of a new product.
- Q. Reuse: Making use of a material without altering its form.
- R. Salvage: Recovery of materials for on-site reuse or donation to a third-party.

1.4 SUBMITTALS

- A. General: Submit in accordance with Section 01 33 00.
- B. Special Environmental Requirements Submittals:
 - 1. Construction Waste Management Plan.
 - 2. Letter signed by Contractor, tabulating the total waste material, quantities diverted and the means by which diverted, and declaring that the waste diversion requirements have been met.
 - 3. Certifications from C&D Recycling Facilities that will receive C&D debris.
- C. Pay Application Requirements as described in this Section including but not limited to: Waste Management Log, receipts, invoices, weigh tickets, and a summary sheet.

1.5 QUALITY ASSURANCE

- A. C&D Recycling Facility Qualifications:
 - 1. Operations legally qualified to accept C&D waste in compliance with CIWMB rules and regulations and the local Enforcement Agency.
- B. Regulatory Requirements: Comply with CIWMB and local EA rules and regulations.
- C. Monitoring:
 - 1. Project Inspector shall monitor removal of C&D debris to verify the required material designated to be recycled are being properly sorted and removed from site to be delivered to recycling facility. Contractor shall coordinate with Project Inspector to have all loads, recycled and non-recycled, verified prior to off-haul. Project Inspector shall initial all receipts, invoices, manifests, and weigh tickets.
 - 2. Additional Pay Application Requirements: Submit the following as a requirement for pay application:
 - a. Waste Management Log with attached receipts, invoices, weigh tickets, and a summary sheet duly initialed by Project Inspector.
 - b. Certification letter stating that, under the penalty of perjury, all materials removed from the site during the billing period are included in the waste management log, summary sheet, and attachments.
 - c. Failure to submit these requirements with pay application will prohibit processing of pay application.
 - 3. Coordination, Meetings, and Training: Comply with provisions specified in this Section.

1.6 CONSTRUCTION WASTE MANAGEMENT PLAN

- A. At least 7 days prior to start of the Work of this Project, and prior to any waste removal from the project site, Contractor shall develop and submit to Architect and Owner a Construction and Demolition Waste Management Plan as specified in this Section for review.
- B. The Construction Waste Reduction Plan shall, as a minimum, address the following:
 - 1. Identify the construction and demolition waste materials to be diverted from disposal by efficient usage, recycling, reuse on the project or salvage for future use or sale.
 - 2. Determine if construction and demolition waste materials will be sorted on-site (source-separated) or bulk mixed (single stream).

3. Identify diversion facilities where construction and demolition waste material collected will be taken.
4. Specify that the amount of construction and demolition waste materials diverted shall be calculated by weight or volume, but not by both.
5. As a minimum, the following materials shall be reused or recycled:
 - a. Concrete.
 - b. Metals.
 - c. Wood.
 - d. Plywood, oriented strand board (OSB), medium density fiberboard (MDF), and other wood sheet materials.
 - e. Rigid foam.
 - f. Window glass.
 - g. Gypsum board.
 - h. Acoustical ceiling panels.
 - i. Carpet and pad.
 - j. Paint (through hazardous waste outlets).
 - k. Piping: steel, copper, plastic, and cast iron.
 - l. Fluorescent lights and ballasts.
 - m. Cardboard, paper, plastic film, and packaging.
 - n. Job shack wastes, including office paper, cardboard, glass, plastic, and aluminum beverage cans.
6. Describe methods to prevent storm water run-on from contacting stored construction waste. Methods may include but not limited to berms, secondary containment, and covered dumpster/roll-offs. Where dumpsters are used, include number of dumpsters and frequency of pick-up.

C. Plan Implementation:

1. Waste Management Coordinator: Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.
2. Maintain log of each load, of each category item diverted from landfill. Log in separately debris sent to a Class III landfill and materials sent to recycling facilities.
 - a. Include in log type of load, load volume, recycling/hauling service, date accepted by recycling service or by landfill.
 - b. Owner reserves the right to audit the log at any time, retain all weight tickets, and receive copies of receipts and invoices.
 - c. Units of measure: Use same units as stated in the approved plan good faith estimate of construction waste which would be generated if no remedial methods were implemented.
3. Materials Handling:
 - a. Materials to be recycled shall be protected from contamination, and shall be handled, stored and transported in a manner that meets the requirements set by the designated facilities for acceptance.

4. Separation Facilities:

- a. Designate a specific on-site area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return.
- b. Keep waste bin areas neat and clean. Clearly mark bins. Do not commingle non-recyclable waste with materials designated for reuse or recycling.
- c. For separation at an off-site facility that uses facility average diversion rates, those diversion rates must be regulated by a local or state government authority, and a documenting letter stating such shall be provided.

5. Training and Coordination:

- a. Furnish copies of the Waste Management Plan to Owner, Architect, all on-site supervisors, and each subcontractor.
- b. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all entities at the appropriate stages of the Project.
- c. Meetings: Include construction waste management on the agenda of regularly scheduled job-site meetings.

6. Transportation:

- a. A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials. Provide an estimate of how often bins will need to be emptied.
- b. Transport materials in covered trucks to prevent contamination of product or littering or polluting of surrounding areas.

D. Waste Reduction Strategies:

1. Include in supply agreements with vendors, a waste reduction provision, specifying a preference for reduced, returnable, and/or recyclable packaging.
2. Use detailed material estimates to reduce risk of unplanned and potentially wasteful cuts.
3. Store materials properly to avoid moisture damage or other damage to materials as well as outdating. Materials that become wet or damp due to improper storage shall be replaced at Contractor's expense.

1.7 SPECIAL PROGRAMS

- A. Contractor shall be responsible for final implementation of programs involving tax credits or rebates or similar incentives related to recycling, if applicable to the Project. Revenues or other savings obtained for recycled, reused, or salvaged materials shall accrue to Contractor.
- B. Contractor shall document work methods and recycled, reused, or salvaged materials that qualify for tax credits, rebates, and other savings.

1.8 SUBSTITUTIONS

- A. Should Contractor desire to use procedures, materials, equipment, or products that are not specified but meet the intent of these specifications and are equal to the products specified in all aspects to reduce materials waste, Contractor shall propose these substitutions under provisions of Section 01 60 00.

1.9 VOLUME TO WEIGHT CONVERSION

- A. The table found at www.usgbc.org/resources/table-2-volumetoweight-conversion-construction-and-demolition-debris shall be used for all volume to weight conversions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

- A. Implement waste management plan as approved by Architect and Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

3.2 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- B. Burning: Do not burn waste materials on Owner's property.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them off-site.

END OF SECTION

SECTION 03 11 00
CONCRETE FORMING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete formwork, shoring, bracing, and anchorage at non-PC areas of work for the Project.
- B. Concrete formwork accessories at non-PC areas of work for the Project.

1.2 RELATED SECTIONS

- A. Section 03 20 00 – Concrete Reinforcing.
- B. Section 03 30 00 – Cast-In-Place Concrete.
- C. Section 31 20 00 – Earth Moving.

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. ACI SPEC-301 – Specifications for Concrete Construction.
 - 2. ACI PRC-347 – Guide to Formwork for Concrete.
 - 3. AHA A135.4 – Basic Hardboard.
 - 4. PS 1 – Structural Plywood.

1.4 DESIGN REQUIREMENTS

- A. Design, engineer, and construct concrete formwork, shoring, and bracing in accordance with design and code requirements, resulting in cast-in-place concrete conforming to required shape, line, and dimension.

1.5 SUBMITTALS

- A. Submit in accordance with Division 01.
- B. Product Data: Submit manufacturer's descriptive literature and product specifications for the following:
 - 1. Forms for architectural cast concrete finish.
 - 2. Accessories:
 - a. Chamfer strips.

- b. Keyed construction joint.
- c. Form ties.
- d. Form release agent.

C. Shop Drawings: Indicate dimensions, materials, bracing, and location of joints and ties.

1.6 QUALITY ASSURANCE

- A. Conform to ACI PRC-347 for design, fabrication, erection, and removal of forms.
- B. Field Samples: Provide only as requested by Architect.
- C. Pre-Installation Meetings:
 - 1. Conduct pre-installation meeting in accordance with Division 01.
 - 2. Convene pre-installation meeting prior to commencing work of this Section.
 - 3. Coordinate work in this Section with work in related Sections.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Architectural Cast Concrete Finish:
 - 1. Phenolic-faced plywood (minimum 167 g/m² on both faces); minimum 5/8 inch thickness; conforming to PS 1 APA HDO Plyform Class II or better; sound, undamaged sheets with clean, true edges, joints taped.
- B. Smooth Concrete Concealed from View: Plywood; 5/8 inch minimum thickness; conforming to PS 1 APA B-B Plyform Class II or better.
- C. Concrete Concealed from View:
 - 1. 2x lumber, plywood conforming to PS 1 APA Plyform Class II or better, tempered concrete form hardboard conforming to AHA A135.4, or other acceptable material.

2.2 ACCESSORIES

- A. Chamfer Strips: Wood, metal, or rubber strips; size as shown on Drawings, minimum 3/4 inch by 3/4 inch.
- B. Expansion Joint Filler: Refer to Section 03 30 00.
- C. Foam Board Separation: Expanded polystyrene in size and thickness to suit application.
- D. Keyed Construction Joint: Minimum 24 gauge galvanized steel; shaped with formed key (minimum 1-1/2 inch) for load transfer; and with knockouts for dowel placement.
 - 1. Basis of Design Product: G33 Screed Key Joint by Dayton Superior Corporation, Miamisburg, OH; 800-745-3700; www.daytonsuperior.com. Provide the named product or accepted equal.
- E. Form Ties: Provide as indicated and as required.
 - 1. Galvanized steel; adjustable length; cone type; snap-off type with 1 inch back break dimension; free of defects that could leave holes larger than 1 inch in concrete surface.

2. Substitution: In lieu of galvanized steel ties, Contractor may use stainless steel form ties of equal or higher strength.
 - a. Stainless Steel Form Tie System:
 - 1) Stainless Steel Snap Tie, Product No. A44 by Dayton Superior Corporation, Miamisburg, OH; 800-745-3700; www.daytonsuperior.com.
 - 2) Stainless Steel Snap Ties by Meadow Burke, Riverview, FL; 877-518-7665, www.meadowburke.com.
 - 3) Or accepted equal.
- F. Plastic Stakes: At Contractor's option, solid plastic stakes may be used in lieu of wood and steel stakes. Provide solid plastic stakes for use in areas with continuous vapor retarder.
 1. Basis of Design Product: VaporStake by VaporStake LLC, Lake Elsinore, CA; 714-519-4211, www.vaporstake.com.
 2. Material: Non-corrosive, leak-resistant, solid PVC, with one pointed end and multiple pre-drilled holes for nailing; diameter and length as recommended by stake manufacturer, and as required by field conditions.
- G. Nails, Spikes, Lag Bolts, Through-Bolts, Anchors: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- H. Spreaders: Metal; use of wood spreaders will not be permitted.
- I. Form Release Agent: Commercially formulated form release agents that will not bond with, stain or adversely affect concrete surface, and will not impair subsequent treatment of concrete surfaces, nor impede the wetting of surfaces to be cured with water or curing compounds. Product shall meet the VOC requirements at the location of use.
 1. Product: Duogard W.R. Meadows.
 2. MasterFinish RL Series by Master Builders Solutions.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine job site conditions and verify field dimensions.
- B. Report unacceptable conditions to Architect. Begin installation only when unacceptable conditions have been corrected.

3.2 EARTH FORMS

- A. Concrete may be placed against cut earth where feasible, conforming to the following criteria:
 1. Earth form trenches shall be able to stand without caving in.
 2. Sloughage will not be permitted.
 3. When, in the opinion of the Building Official and Architect, soil conditions do not require formwork per CBC Section 1808A.8.5.
- B. Hand trim sides and bottoms of earth forms. Remove loose soil prior to placing concrete.

3.3 FORMWORK ERECTION

- A. Erect formwork, shoring, and bracing in accordance with ACI SPEC-301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit ease of dismantling and stripping and prevent damage to concrete during stripping.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval from Architect before framing openings not specifically indicated on Drawings.
- F. Stakes (wood and metal) used to support formwork or reinforcement, will not be permitted to occur within finished concrete work.
 - 1. Pulling of stakes and puddling concrete in after concrete placement will not be permitted.
 - 2. Locate non-plastic stakes appropriately to prevent embedment of stakes in the concrete after placement.

3.4 FORM RELEASE AGENT APPLICATION

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent.
- D. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Locate and set in place items which will be cast directly into concrete.
- B. Coordinate work of other Sections such as but not limited to openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install accessories in accordance with manufacturer's written installation instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- D. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

3.6 CONSTRUCTION JOINTS

- A. Refer to Section 03 30 00.
- B. Locate construction joints so as not to impair the strength of the structure and only at locations indicated on Drawings and as acceptable to Architect. Form keys in cold joints as shown or required.

3.7 FORMWORK CLEANING AND INSPECTION

- A. Inspect erected formwork, shoring and bracing to ensure that work is in accordance with formwork design and that supports, fastenings, wedges, ties, and embedded items are secure to prevent displacement and distortions.
- B. Clean forms and adjacent surfaces as formwork is erected and prior to concrete placement. Remove wood chips, sawdust, dirt, and other debris.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain through cleaning ports.
- D. Close temporary openings with tight fitting panels, flush with inside face of forms and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.8 ADJUSTMENTS

- A. When a concrete pour has been stopped for a sufficient length of time so that shrinkage or warp has separated the forms and the concrete, provide for form adjustment to draw the forms into firm contact with concrete before placing additional concrete. Take precautions to prevent any shoulder or ledge from being formed at a cold joint.

3.9 FORM REMOVAL

- A. Refer to Section 03 30 00.
- B. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- C. Remove forms progressively and in accordance with ACI PRC-347.

3.10 FORM REUSE

- A. Forms in good condition may be reused.
- B. Clean and inspect forms prior to reuse. Do not re-use split, warped, delaminated, or otherwise damaged forms that will impair surface condition and quality of cast concrete exposed to view.
- C. Do not reuse wood formwork more than two times for architectural finish exposed concrete and three times for concrete surfaces to be exposed to view. Do not patch formwork.

3.11 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI PRC-347.
- B. Concrete work out of alignment, level or plumb will be cause for rejection of the whole work affected and, if so rejected, such work shall be removed and replaced, as directed by Architect, at no cost to Owner.
- C. All concrete exposed to view, except as otherwise indicated and specified shall have a smooth finish of uniform texture, free from form marks or other visible irregularities and free from form coating, oils or other matter that will prevent bonding of patching work, painting or other finish materials.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel reinforcement and accessories for concrete at non-PC areas of work for the Project.

1.2 RELATED SECTIONS

- A. Section 03 11 00 – Concrete Forming.
- B. Section 03 30 00 – Cast-in-Place Concrete.

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. ACI SPEC-117 – Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI SPEC-301 – Specifications for Structural Concrete.
 - 3. ACI CODE-318 – Building Code Requirements for Structural Concrete and Commentary.
 - 4. ACI MNL-66 – ACI Detailing Manual.
 - 5. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 6. ASTM A706/A706M – Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01.
- B. Product Data: Submit manufacturer's descriptive literature, written installation instructions, and product specification for the following products:
 - 1. Mechanical splicing devices.
 - 2. Bar supports.
- C. Placement Drawings:
 - 1. Prepare in accordance with ACI MNL-66.
 - 2. Indicate bar sizes, spacing, locations, and quantities of steel reinforcement, bending and cutting schedules, and supporting and spacing devices.

3. Identify placement drawings with reference to sheet and detail numbers from the Contract Documents.
4. Do not use scaled dimensions from Drawings to determine lengths of steel reinforcement.
5. Submit one copy of reproducible placement drawings in addition to those required by Division 01.
6. Contractor shall be responsible for correctness and completeness of steel reinforcing requirements.
7. Begin fabrication only when placement drawings have been accepted.

D. Quality Assurance/Control Submittals:

1. Submit testing per 2025 CBC Section 1910A "Concrete, Reinforcement and Anchor Testing," Article 1910A.2 "Tests of Reinforcing Bars".
2. Submit certified copies of mill test reports of reinforcing materials analysis to Owner's testing agency.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with CRSI Manual of Standard Practice; ACI SPEC-301; and 2025 California Building Code (CBC) Chapter 17A "Special Inspections and Tests", and Chapter 19A "Concrete", and as follows:
1. Steel Reinforcement, Tests and Materials: CBC Section 1903A "Specifications for Tests and Materials".
 2. Anchorage: CBC Section 1910A.5.
- B. Structural Tests and Inspections: Refer to DSA Statement of Structural Tests and Special Inspections (DSA Form DSA-103).
- C. Pre-Installation Meetings:
1. Conduct pre-installation meeting in accordance with Division 01.
 2. Convene pre-installation meeting prior to commencing Work of this Section.
 3. Coordinate Work in this Section with Work in related Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Division 01.
- B. Deliver steel reinforcement in bundles marked with identification tags.
- C. Handle and store materials to prevent damage and contamination, excessive rusting or coating with grease, oil, or other objectionable materials.
- D. Store steel reinforcement, fabricated assemblies, and accessories off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Steel:

1. ASTM A615/A615M, Grade 60, low-alloy deformed steel bars.

2. ASTM A706 for welded bars.

B. Holding Wires: ASTM A1064/A1064M.

C. Tie Wire: Black annealed steel wire; No. 16 gauge.

2.2 ACCESSORIES

A. Bar Supports (Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place): Provide in accordance with CRSI Manual of Standard Practice from steel wire, plastic, or precast concrete or fiber-reinforced concrete of equal to or greater compressive strength than surrounding concrete. Provide as follows:

1. Footings: Precast concrete blocks with tie wires.
2. Slab on ground: Precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.
3. Where legs of wire bar supports contact forms: CRSI Class 1 plastic-protected or CRSI Class 2 stainless steel bar supports.
4. Where support is no closer to concrete surface than 1/2 inch: CRSI Class 3 wire supports.
5. Supports placed against ground: Precast concrete blocks not less than 4 inch square with embedded wire.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine job site conditions and verify field dimensions.
- B. Report unacceptable conditions to Architect. Begin installation only when unacceptable conditions have been corrected.

3.2 PREPARATION

- A. Clean steel reinforcement of rust and mill scale, earth, moisture, and other foreign materials before fabrication or placement.

3.3 STEEL REINFORCEMENT FABRICATION

- A. Fabricate to shapes, dimensions, and tolerances in accordance with accepted placement drawings conforming to CRSI Manual of Standard Practice, ACI MNL-66, ACI CODE-318, ACI SPEC-117, and CBC Chapter 19A.
- B. Standard Hooks and Bends: Conform to ACI CODE-318.
- C. Bending: Cold bend steel reinforcement in the field or at the mill. Heating for bending is not permitted unless otherwise specifically allowed by Architect and DSA.
- D. Reinforcement must not be straightened or re-bent without approval of DSA.

3.4 PLACEMENT

- A. Place steel reinforcement in accordance with accepted placement drawings in conformance with tolerances specified in ACI SPEC-117.

- B. Install steel reinforcement in largest practical lengths. Accurately position, support, and secure reinforcement against displacement. Locate support reinforcement with bar supports to maintain minimum concrete cover.
- C. Secure reinforcement against displacement within tolerances permitted in ACI CODE-318. Point wire tie ends away from forms.
- D. Concrete Cover: Cover tolerances shall comply with ACI SPEC-117. Provide concrete cover with a minimum clear dimension from face of steel reinforcement as follows unless otherwise noted:
 - 1. Concrete cast against earth (except slab on ground): 3 inches.
 - 2. Slab on ground: Center steel reinforcement in slab.
 - 3. Concrete formed and exposed to weather:
 - a. No. 6 through No. 18 bars: 2 inches.
 - b. No 5 bar, W31 or D31 wire and smaller: 1-1/2 inch.
 - 4. Concrete not exposed to weather or in contact with the ground:
 - a. Beams and columns: 1-1/2 inch.
 - b. Slabs and walls:
 - 1) No. 14 and No. 18 bars: 1-1/2 inch.
 - 2) No. 11 bars and smaller: 3/4 inch.
- E. Laps: Lap continuous steel reinforcement as follows unless otherwise noted:
 - 1. Normal Weight Concrete:
 - a. Slab on ground, concrete filled steel deck, and structural slab:
 - 1) No. 6 bar and smaller: 56 times nominal bar diameter.
 - 2) No. 7 bar and larger: 72 times nominal bar diameter.
 - b. All other concrete:
 - 1) No. 6 bar and smaller: 80 times nominal bar diameter.
 - 2) No. 7 bar and larger: 96 times nominal bar diameter.
 - 2. Offset laps in adjacent bars.
- F. Splices:
 - 1. Splice reinforcing as shown.
 - 2. Tie lap splices securely to prevent displacement during concrete placement.
 - 3. Locate splices only where shown and accepted by Architect.
- G. Maintain minimum clear distance between parallel bars at not less than 1-1/2 times nominal bar diameter, 1-1/2 times maximum size of coarse aggregate, or 1-1/2 inch.
- H. Dowels: Place where indicated on Drawings. Grease loose end to prevent concrete from bonding to dowel. Sleeves may be used when accepted by Architect.
- I. Field Adjustments: Move steel reinforcement as necessary to avoid interference with other reinforcing steel or other embedded items within accepted tolerances.
 - 1. Sleeves and embedded items: Do not cut bars to clear sleeves or slots through slabs or walls. Wrap bars around these openings.

2. Openings: Compensate for steel reinforcement terminated at openings in slabs by placing one half of steel reinforcement terminated on each side of openings for the full span length.
3. Steel reinforcement moved to avoid interference with other reinforcements, conduits, or embedded items, including additional steel reinforcement to meet structural requirements are subject to inspection and approval before concrete placement.

3.5 FIELD QUALITY CONTROL

- A. General: Comply with requirements of Division 01.
- B. Testing Service: Owner will select and pay for independent testing agency, which will perform testing and inspection indicated on Drawings and DSA Statement of Structural Tests and Special Inspections (DSA Form DSA-103).
- C. Project Inspector shall inspect placement of steel reinforcement.

3.6 PROTECTION

- A. Protect steel reinforcement from damage and displacement.
- B. Protect for potential rust staining of adjacent surfaces. Wrap steel reinforcement with impervious tape or other methods as accepted by Architect. Remove protective cover and clean reinforcement before concrete placement.
- C. Install safety caps on all exposed ends of vertical steel reinforcement that pose a danger to life safety.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cast-in-place concrete at non-PC areas of work for the Project.
 - 1. Architectural concrete at exposed locations in non-PC areas of work for the Project.
- B. Concrete admixtures.
- C. Curing and surface slab treatment.
- D. Grouting, bonding, and patching materials.
- E. Accessories:
 - 1. Waterstops.
 - 2. Expansion joints.

1.2 RELATED SECTIONS

- A. Section 03 11 00 – Concrete Forming.
- B. Section 03 20 00 – Concrete Reinforcing.
- C. Section 07 13 26 – Self-Adhering Sheet Waterproofing.
- D. Section 31 20 00 – Earth Moving.
- E. Section 33 41 00 – Storm Utility Drainage Piping.
- F. Section 33 46 00 – Subdrainage.

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. ACI publications PRC-221, PRC-302.1, PRC-302.2, PRC-303, and PRC-304 contain recommended practices for concrete work. Submit any proposed deviations from these recommendations to Architect for review prior to commencing concrete work.
- D. Referenced Standards:
 - 1. ACI SPEC-117 – Standard Specification for Tolerances for Concrete Construction and Materials.
 - 2. ACI PRC-221 – Guide for Use of Normal Weight and Heavyweight Aggregates in Concrete.

3. ACI SPEC-301	– Specifications for Structural Concrete.
4. ACI PRC-302.1	– Guide to Concrete Floor and Slab Construction.
5. ACI PRC-302.2	– Concrete Slabs that Receive Moisture-Sensitive Flooring Materials – Guide.
6. ACI PRC-303	– Guide to Cast-in-Place Architectural Concrete Practice.
7. ACI PRC-304	– Guide for Measuring, Mixing, Transporting, and Placing Concrete.
8. ACI SPEC-305.1	– Specification for Hot Weather Concreting.
9. ACI SPEC-306.1	– Standard Specification for Cold Weather Concreting.
10. ACI CODE-318	– Building Code Requirements for Structural Concrete.
11. ACI SP-15	– Field Reference Manual: Specifications for Structural Concrete ACI 301-10 with Selected ACI References.
12. ASTM C31/C31M	– Standard Practice for Making and Curing Concrete Test Specimens in the Field.
13. ASTM C33/C33M	– Standard Specification for Concrete Aggregates.
14. ASTM C39/C39M	– Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
15. ASTM C94/C94M	– Standard Specification for Ready Mixed Concrete.
16. ASTM C109/C109M	– Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
17. ASTM C114	– Standard Test Methods for Chemical Analysis of Hydraulic Cement.
18. ASTM C138/C138M	– Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
19. ASTM C143/C143M	– Standard Test Method for Slump of Hydraulic Cement Concrete.
20. ASTM C150/C150M	– Standard Specification for Portland Cement.
21. ASTM C157/C157M	– Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
22. ASTM C171	– Standard Specification for Sheet Materials for Curing Concrete.
23. ASTM C172/C172M	– Standard Practice for Sampling Freshly Mixed Concrete.
24. ASTM C309	– Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
25. ASTM C494/C494M	– Standard Specification for Chemical Admixtures for Concrete.
26. ASTM C618	– Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
27. ASTM C881/C881M	– Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
28. ASTM C928/C928M	– Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.

- 29. ASTM C939/C939M – Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
- 30. ASTM C1059/C1059M – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
- 31. ASTM C1064/C1064M – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
- 32. ASTM C1077 – Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- 33. ASTM C1107/C1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- 34. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- 35. ASTM C1602/C1602M – Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- 36. ASTM D624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- 37. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- 38. ASTM D2240 – Standard Test Method for Rubber Property-Durometer Hardness.
- 39. ASTM D4397 – Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
- 40. ASTM E303 – Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
- 41. ASTM E329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- 42. ASTM E1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.
- 43. CRD-C48 – Standard Test Method for Water Permeability of Concrete
- 44. ISO/IEC/EN 17025 – General Requirements for the Competence of Testing and Calibration Laboratories (formerly ISO/IEC Guide 25-1990 and ASTM E548).

1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01.
- B. Product Data: Submit manufacturer's descriptive literature and product specification for each product. Include manufacturer's written installation instructions and installation procedures.
- C. Drawings: Submit concrete pouring plan showing proposed locations of construction and control joints for review by Architect prior to concrete placement.
- D. Samples: Submit product samples when requested by Architect or testing laboratory.

E. Quality Assurance/Control Submittals:

1. Certificates:
 - a. Manufacturer's Certification of Compliance that materials (cementitious materials, aggregates, and admixtures) conform to specifications.
2. Reference Documents: Maintain one copy of ACI SP-15 on site.
3. Concrete mixture proportions and characteristics for each class/type of concrete used.
4. Concrete mixture proportion data for each class/type of concrete used:
 - a. Calculation of required average compressive strength and supporting test records.
 - b. Documentation indicating proposed mixture proportions will produce an average compressive strength greater than the required average compressive strength, including field strength test records or trial mixtures.
 - c. Provide documentation in accordance with Concrete Mix Design Submittal Checklist located at the end of this Section.
5. Test Reports.
6. Batch Ticket: Furnish accepted batch tickets at the time of delivery for each concrete load. Indicate on each ticket equipment used for measuring and quantities, by weight, of cement, sand, each class of aggregate, admixtures, and amount of water in the aggregate, water added at the batching plant, and any water withheld at the batch plant. In addition, include mix number, total yield in cubic yards, date and time of day (dispatch time, plant departure time, site arrival time, unloading start and end time).
7. Concrete Placement Record: Keep a record on site including time and date of concrete placing for each portion of the structure for the duration of the project. Record additional information not included in batch ticket such as admixtures added at the job site. Make records available to Architect and DSA for review. Submit record to Architect at project completion.
8. Protection of Slabs and Foundations: Submit plans for protection of slabs and foundations, including the following, if applicable:
 - a. Cold Weather Concreting: Comply with submittal requirements of ACI SPEC-306.1.
 - b. Hot Weather Concreting: Comply with submittal requirements of ACI SPEC-305.1.

F. Closeout Submittals:

1. Concrete placement record.
2. Show location of embedded utilities in record drawings.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Concrete Supplier: Firm specializing in products specified in this Section with a minimum five years' documented experience; successfully supplying similar materials (design, content, and performance) as specified in this Section.
2. Concrete Batch Plant: Complies with requirements of ASTM C94, Sections 9 and 10, and is currently certified per NRMCA Plant Certification Checklist - Section 3 or other certification acceptable to Architect and DSA.
3. Contractor's Design Laboratory: Under the direction of civil engineer licensed by the State of California; conforming to ASTM E329 and ASTM C1077.

4. Independent Testing Laboratory: Conforming to ASTM E329, ASTM C1077, and ISO/IEC/EN 17025, acceptable to Architect and DSA.
- B. Structural Tests and Inspections: Refer to DSA Structural Tests and Inspection Sheet (Form DSA-103).
- C. Regulatory Requirements:
 1. Conform to requirements of 2025 California Building Code (CBC), Chapter 19A, "Concrete", Chapter 17A "Special Inspections and Tests", and as follows:
 - a. Materials:
 - 1) Cementitious Materials: CBC Chapter 19A, Section 1903A "Specifications for Tests and Materials" and Section 1910A.1 "Cementitious Material".
 - 2) Batch Plant Inspection: CBC Section 1705A, Paragraph 1705A.3.3 "Batch Plant Inspection".
 - b. Quality:
 - 1) Composite Construction Cores: CBC Section 1910A, Paragraph 1910A.4 "Composite Construction Cores".
 - c. Inspection: CBC Chapter 17A, Section 1705A "Required Special Inspections and Tests" Article 1705A.3 "Concrete Construction", as applicable.
 - 1) Batch Plant Weighmaster Inspection: CBC Section 1705A, Paragraph 1705A.3.3 "Batch Plant Inspection".
- D. Drying Shrinkage Test: Perform per ASTM C157/C157M modified as follows:
 1. Prepare 4 inch x 4 inch x 11 inch prisms with an effective gage length of 10 inches fabricated, cured, dried, and measured per ASTM C157/C157M except that specimens shall be removed from molds at an age of 23 hours plus or minus 1 hour after trial batching, and shall be placed immediately in water at 73 degrees F plus or minus 3 degrees for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F plus or minus 3 degrees.
 2. Measurement to determine expansion expressed as a percentage of original length shall be made at 7 days. This length at 7 days shall be the base length for drying shrinkage calculations. Specimens shall then be stored immediately in a humidity control room, maintained at 73 degrees F plus or minus 3 degrees F and 50 percent plus or minus 4 percent relative humidity for the remainder of the test.
 3. Measurements to determine shrinkage expressed as a percentage of base length shall be made and reported separately for 7, 14, and 21 days of drying after 7 days of moist curing.
- E. Quality Control: Comply with NRMCA Quality Control Checklist – Section 2.
- F. Materials Quality Assurance: Obtain cement and aggregates from same source for the duration of the work unless specifically accepted by Architect.
- G. Pre-Installation Meetings:
 1. Conduct pre-installation (pre-pour) meeting in accordance with Division 01.
 2. Convene pre-installation (pre-pour) meeting one week prior to commencing work of this Section attended by concrete supplier.

3. Meeting minutes shall be taken and distributed to meeting attendees within 3 days of meeting.
4. Coordinate work in this Section with work in related Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 1. The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
 2. Evonik Industries AG, Piscataway, NJ; 973-929-8000, www.evonik.com.
 3. GCP Applied Technologies, Inc., Alpharetta, GA; 877-423-6491, <https://gcpat.com>.
 4. Master Builders Solutions, Beachwood, OH; 800-228-3318, www.master-builders-solutions.com.
 5. Viaflex, Inc., Sioux Falls, SD; 800-635-3456, www.viaflex.com.
 6. Reef Industries, Inc., Houston, TX; 800-231-6074, www.reefindustries.com.
 7. Sika Corporation, Lyndhurst, NJ; 800-933-7452, www.usa.sika.com.
 8. Stego Industries, LLC, San Clemente, CA; 877-464-7834, www.stegoindustries.com.
 9. US Spec, a Division of US Mix Products Co., Denver, CO; 800-397-9903, www.usspec.com.
 10. Vinylex Corp., www.usa.sika.com.
 11. W. R. Meadows, Inc., Hampshire, IL; 800-342-5976, www.wrmeadows.com.
- B. Substitutions: Manufacturers and products are listed in this Section to establish minimum requirements as to quality and performance. Comply with requirements of Division 01 for substitutions.

2.2 CONCRETE MATERIALS

- A. Cementitious Materials:

1. Cement: ASTM C150, Type II, low alkali (equivalent alkalis ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) no more than 0.6 percent per ASTM C114), gray.
 2. Supplementary Cementitious Materials (SCM):
 - a. Fly Ash: ASTM C618, Class F. Class C is not permitted.
 3. Allowable SCM for Concrete Mix: Percentage, by weight, of cementitious materials, other than Portland cement in concrete, is as listed in the Mix Design Table on the Drawings, with individual limits by material noted below. SCM quantity shall include non-Portland cement portions of blended cements.
 - a. Fly Ash: 25 percent maximum.
- B. Aggregates: Aggregates used in concrete shall have a combined aggregate distribution similar to the aggregates used in the concrete represented by field test data or used in trial mixtures. Fine and coarse aggregates: ASTM C33. Low-shrinkage producing coarse aggregates per ACI PRC-221; and uniformly graded per the table on the following page:

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

1. Maximum Nominal Size of Coarse Aggregate: CBC Section 1903A Specifications for Tests and Materials, and as follows:
 - a. 1/5 the narrowest dimension between sides of forms,
 - b. 1/3 depth of slab, or,
 - c. 3/4 the minimum clear spacing between individual reinforcing bars.
 2. Aggregate sources shall not contain any alkali-silica reactive material in accordance with ASTM C33, Appendix XI.
- C. Water: Potable and complying with ASTM C1602/C1602M.

2.3 ADMIXTURES

A. General:

1. Manufacturer certified to contain no intentionally added chlorides.
2. Compatible with other admixtures and cementitious materials in the concrete mix. Admixtures in a single mix shall be from a single manufacturer unless specific documentation verifying compatibility is provided.
3. Obtain Architect's and DSA's written acceptance prior to use of admixtures. Use admixtures according to manufacturer's written installation instructions.

B. Water Reducing Admixtures:

1. Normal Range: ASTM C494/C494M, Type A.
 - a. Acceptable Products:
 - 1) MasterPozzolite Series by Master Builders Solutions.
 - 2) Eucon Series by The Euclid Chemical Co.
 - 3) WRDA 64 by GCP Applied Technologies, Inc.
 - 4) Plastocrete 161 by Sika Corp.
 - 5) Or accepted equal.
2. Mid-Range Water-Reducing: ASTM C494/C494M, Type A or Type F.
 - a. Acceptable Products:
 - 1) MasterPolyheed Series by Master Builders Solutions.
 - 2) Eucon Series by The Euclid Chemical Co.
 - 3) Daracem 55 by GCP Applied Technologies, Inc.
 - 4) Or accepted equal.
3. High Range Water-Reducing: ASTM C494/C494M, Type F or G.
 - a. Acceptable Products:
 - 1) MasterRheobuild 1000 or MasterGlenium Series by Master Builders Solutions.
 - 2) Eucon Series or Plastol Series by The Euclid Chemical Co.
 - 3) Daracem 100 by GCP Applied Technologies, Inc.
 - 4) Sikament Series by Sika Corp.
 - 5) Or accepted equal.

C. Shrinkage Reducing Admixtures: Reduces dry shrinkage up to 80 percent at 28 days, and up to 50 percent at 1 year and beyond as tested per ASTM C157/C157M.

1. Acceptable Products:
 - a. MasterLife SRA Series or MasterLife CRA 007 by Master Builders Solutions.
 - b. Eclipse Floor 200 and Eclipse 4500 by GCP Applied Technologies, Inc.
 - c. Eucon SRA Series or Conex by The Euclid Chemical Co.
 - d. Or accepted equal.

D. Retarding Admixtures: ASTM C494/C494M, Type B or Type D.

1. Acceptable Products:

- a. MasterSet R Series or MasterSet DELVO Series by Master Builders Solutions.
 - b. Eucon Retarder Series, Eucon DS, or Eucon Stasis by The Euclid Chemical Co.
 - c. Or accepted equal.
- E. Accelerating Admixtures: ASTM C494/C494M, Type C or Type E.
 - 1. Acceptable Products:
 - a. MasterSet AC 534 or MasterSet FP 20 by Master Builders Solutions.
 - b. Accelguard Series by The Euclid Chemical Co.
 - c. Or accepted equal.
- F. Workability-Retaining Admixtures: Shall retain concrete workability without affecting time of setting or early-age strength development. ASTM C494/C494M, Type S.
 - 1. Acceptable Products:
 - a. MasterSure Z 60 by Master Builders Solutions.
 - b. Plastol AMP Series by The Euclid Chemical Co.
 - c. Or accepted equal.
- G. Permeability-Reducing Admixtures: ASTM C494/C 494M, Type S.
 - 1. Shall be a Portland cement-based crystalline capillary waterproofing admixture that reacts in concrete to form insoluble crystalline hydration products in the capillary pores of concrete.
 - 2. Shall show a reduction in permeability of concrete compared to an identical concrete mixture without the admixture, when tested in accordance with CRD-C48 at a pressure of 200 psi.
 - 3. Shall reduce or have no penetration of water compared to an identical concrete mixture without the admixture, when tested in accordance with DIN 1048 for a duration of 96 hours.
 - 4. NSF/ANSI-61 certified.
 - 5. Acceptable Product:
 - a. MasterLife 300 Series by Master Builders Solutions.

2.4 CURING MATERIALS AND SLAB TREATMENT

- A. General:
 - 1. Comply with regulations of the California Air Resources Board and the local Air Pollution Control/Air Quality Management District.
 - a. VOC Limit: 350 g/L.
 - 2. Verify compatibility with subsequent adhesives and coatings before application; furnish Manufacturer's certificate of compatibility. Coordinate with related Sections.
- B. Curing Compound:
 - 1. Water-emulsion, dissipating resin based; meets or exceeds ASTM C309, Type 1, Class B.
 - a. Acceptable Products:
 - 1) Kurez DR-100 by The Euclid Chemical Co.

- 2) 1100 by W. R. Meadows, Inc.
- 3) US SPEC Maxcure Resin Clear by US Spec.
- 4) Or accepted equal.

C. Waterproof Sheet Materials for Curing: ASTM C171 and as follows:

1. Curing paper consisting of two sheets of kraft paper adhered together with a bituminous material with embedded cords or strands of fiber running in both directions not more than 1-1/4 inches apart.
 - a. Tensile strength in machine direction: 30 foot-pounds per inch of width minimum.
 - b. Tensile strength in cross direction: 15 foot-pounds per inch of width minimum.
2. Polyethylene Film: ASTM D4397; minimum 6 mil thickness.
3. White Burlap-Polyethylene Sheeting: Consisting of burlap weighing not less than 9 ounces per square yard extrusion coated on one side with at least 4 mil white opaque polyethylene sheet.

D. Evaporation Retarder: Water-based polymer concentrate, readily dilutable in water.

1. Acceptable Products:
 - a. Sikagard-50 ER by Sika Corporation.
 - b. Eucobar by The Euclid Chemical Co.
 - c. US SPEC Monofilm ER by US Spec.
 - d. Or accepted equal.

E. Surface Retarder: Water soluble liquid, formulated to retard wet surface of mortar in concrete.

1. Acceptable Products:
 - a. MasterFinish EA by Master Builders Solutions.
 - b. Formula F and Formula S by The Euclid Chemical Co.
 - c. Rugasol S by Sika Corp.
 - d. Or accepted equal.

2.5 GROUTING, BONDING, AND PATCHING MATERIALS

A. Grout:

1. Non-Shrink Grout: ASTM C1107, non-metallic aggregate grout; 7000 psi minimum 28-day compressive strength at fluid water ratio per ASTM C939.
 - a. Acceptable Products:
 - 1) SikaGrout-928 by Sika Corporation.
 - 2) NS Grout, Hi-Flow Grout, or Euco Pre-Cast Grout by The Euclid Chemical Co.
 - 3) US SPEC MP Grout by US Spec.
 - 4) Or accepted equal.
2. Non-Shrink Drypack Grout: Non-shrink, natural aggregates, 7000 psi minimum 28-day compressive strength.
 - a. Acceptable Products:
 - 1) SikaGrout-100 GP by Sika Corporation.

- 2) Dry Pack Grout by The Euclid Chemical Co.
- 3) Pac-it Expansive Dry Pack Grout by W.R. Meadows, Inc.
- 4) Or accepted equal.

B. Bonding Materials:

1. Bonding Agent/Admixture:

- a. Acrylic or SBR, latex cement bonding agent/admixture; non-re-emulsifiable; meets or exceeds ASTM C1059, Type II.

1) Acceptable Products:

- a) Akkro-7T, Flex-Con, or SBR Latex by The Euclid Chemical Co.
- b) US SPEC Acrylcoat by US Spec.
- c) Sealtight Acry-Lok by W. R. Meadows, Inc.
- d) SikaThoroseal Acryl 60 by Sika Corporation.
- e) Or accepted equal.

- b. Exterior applications not subject to constant water immersions: Ethyl-vinyl acetate (EVA) copolymer liquid bonding agent and admixture; re-emulsifies once and will not re-wet; meets or exceeds ASTM C1059.

1) Acceptable Products:

- a) Tammsweld by The Euclid Chemical Co.
- b) US SPEC Multicoat by US Mix Products Co.
- c) Or accepted equal.

2. Structural Bonding Epoxy Adhesive: Two-component, 100 percent solids, 100 percent reactive; meets or exceeds ASTM C881/C881M, Type II, Grade 2, Class B or C as appropriate.

a. Acceptable Products:

- 1) Sikadur 31 Hi-Mod Gel LPL or Sikadur 32 Hi-Mod by Sika Corporation.
- 2) Dural 452 MV by The Euclid Chemical Co.
- 3) Rezi-Weld 1000 by W. R. Meadows, Inc.
- 4) Or accepted equal.

C. Repair Mortar: Exceeds ASTM C928, R1 and R2; rapid setting – minimum 1300 psi at 3 hours; 5500 psi at 7 days per ASTM C109.

1. Acceptable Products:

- a. SikaEmaco-1060 or SikaEmaco-1061 by Sika Corporation.
- b. Euco-Speed, Versaspeed series, or Speed Crete 2028 by The Euclid Chemical Co.
- c. US SPEC Transpatch by US Spec.
- d. Or accepted equal.

D. Repair Mortar (for patching over steel): Liquid polymer modified, containing an integral corrosion inhibitor, exceeds ASTM C928, R2; rapid setting – minimum compressive strength 1500 psi at 1 day; 3500 psi at 7 days; 5000 psi at 28 days per ASTM C109.

1. Acceptable Products:

- a. SikaEmaco 423 RS or SikaEmaco 425 Gel Patch by Sika Corporation.
 - b. Concrete-Top Supreme by The Euclid Chemical Co.
 - c. US SPEC H2 by US Mix Products Co.
 - d. Sikatop-122 Plus by Sika Corp.
 - e. Or accepted equal.
- E. Epoxy Joint Filler: Two component, 100 percent solids, semi-rigid epoxy; hardness: minimum 75 Shore A per ASTM D2240.
 - 1. Acceptable Products:
 - a. Sikadur-51 NS by Sika Corporation.
 - b. Euco 700 by The Euclid Chemical Co.
 - c. Or accepted equal.
- F. Polyurea Joint Filler: Two component, 100 percent solids, UV resistant, semi-rigid polyurea; hardness: minimum 80 Shore A per ASTM D2240. Color as selected by Architect from manufacturer's full range of standard colors.
 - 1. Acceptable Products:
 - a. Euco QWIKjoint UVR by The Euclid Chemical Co.
 - b. Sika Loadflex-524 EZ by Sika Corporation.
 - c. Or accepted equal.

2.6 ACCESSORIES

- A. Cone Hole Plugs: Precast high strength cement compound plugs matching size and shape of form tie cone and matching color of poured-in-place concrete as provided by same manufacturer of form ties. Refer to Section 03 11 00.
- B. Waterstops:
 - 1. Flexible PVC Waterstop: Extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment.
 - a. Acceptable Products:
 - 1) Greenstreak PVC Waterstop by Sika Corporation.
 - 2) Vinylex PVC Waterstop by Sika Corporation.
 - 3) Or accepted equal.
 - 2. Characteristics:
 - a. Shore A Hardness: 79 plus or minus 3 per ASTM D2240.
 - b. Tensile Strength: 2000 psi minimum per ASTM D638.
 - c. Elongation: 350 percent per ASTM D638.
 - d. Tear Strength: 300 lb/in minimum per ASTM D624.
 - 3. Provide the following waterstop accessories:
 - a. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.

- b. Provide grommets, pre-punched holes, or hog rings (installed by others) spaced at 12 inches on center along length of waterstop.
- c. Provide Teflon coated thermostatically controlled waterstop welding irons for field butt splices.

C. Expansion Joints:

1. Joint-Filler Strips: ASTM D1751; bituminous type; preformed, resilient, flexible, and non-extruding.
 - a. Acceptable Product:
 - 1) Fibre Expansion Joint by W.R. Meadows, Inc.
 - 2) Or accepted equal.
2. Joint Sealants: Refer to Section 07 92 00.

2.7 CONCRETE MIX

A. General:

1. Proportion concrete design mixes per ACI SPEC-301 Section 4.2.3 and ACI CODE-318 Section 26.4.3.
2. Proportion concrete design mixes per ACI, prepared and tested by an independent testing laboratory acceptable to Architect and DSA prior to design mix approval. For each mix design, prepare and perform tests as follows:
 - a. Drying shrinkage test per modified ASTM C157/C157M as specified in this Section; provide at least 3 test specimens. Drying shrinkage test not required for below grade concrete.
3. Proportioning without field experience or trial mixtures may be permitted with written approval from Architect and DSA, where concrete manufacturer can establish the uniformity of its production for concrete of similar type and strength based on recent test data in accordance with ACI CODE-318, Chapter 26, Article 26.4.4 Documentation of Concrete Mixture Characteristics.
4. Proportion concrete design mix to attain compressive strength as specified below and as needed, with early strength to meet Contractor's work program.

B. Mix Design:

MIX DESIGN TABLE

Location	Req'd SCM (% by weight of total cementitious materials, including blended cements)	Req'd early Compressive Strength (psi)	Req'd 28-day Compressive Strength (psi)	Air Content	Max. W/C Ratio	Max. Air-dry weight (lbs/ft ³)	ACI Exposure Class
General concrete	0 to 25	-	3000	None	0.50	145	F0, S0, P0, C1

1. Maximum Water Content: 300 pounds per cubic yard.
2. Water-Cementitious Materials Ratio: Refer to Drawings.
3. Maximum Drying Shrinkage: 0.048 percent as tested per modified ASTM C157/C157M as specified in this Section after 7 days moist curing plus 21 days drying. This requirement does not apply to below grade concrete.

C. Admixtures:

1. Use specified admixtures as acceptable to Architect and DSA. Verify compatibility of concrete admixtures when using multiple admixtures.

2.8 CONCRETE MIXING

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

2.9 SOURCE QUALITY CONTROL

- A. Owner shall employ a testing laboratory accepted by Architect and DSA to perform the following:
1. Review mix designs and certificates of compliance for materials Contractor proposes to use.
 2. Provide continuous batch plant inspections per CBC Chapter 17A, Paragraph 1705A.3.3 Batch Plant Inspection.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine and verify the following prior to concrete placement.
1. Forms are erected, adequately braced, sealed, lubricated (if required), and bulkhead provided where placing is to stop.
 2. Thoroughly water soak wood forms other than plywood at least 12 hours before concrete placement.
 3. Steel reinforcement are accurately positioned, securely tied and braced. Verify concrete cover requirements.
 4. Coordination with related work is completed.
 5. Anchors and embedded items are in position, securely held and braced.
 6. Construction joints and previously placed concrete are prepared as specified.
 7. Compliance with cold-weather or hot-weather requirements.
 8. Compliance with cleaning and preparation requirements.
- B. Report unacceptable conditions to Architect. Begin installation only when unacceptable conditions have been corrected.
- C. Concrete formwork, reinforcement, inserts, and embedded items are subject to Architect's acceptance. Notify Architect at least 48 hours prior to concrete placement.

3.2 PREPARATION

- A. Cleaning: Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris before placing concrete.
- B. Refer to Section 03 11 00 for formwork preparation.
- C. Refer to Section 03 20 00 for reinforcing steel preparation.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI SPEC-301 and as specified in this Section.
 - 1. Place and finish Architectural Concrete in the locations indicated on Drawings in accordance with ACI PRC-303.
 - 2. Concrete construction tolerances shall be per ACI SPEC-301.
- B. Add no water during delivery and at the project site unless specifically accepted by Architect. If water is withheld at batch plant, indicate in delivery ticket the design water for accepted mix, moisture content of aggregates, and free water added at batch plant. If total water added at plant is less than design water to attain slump of accepted mix design, water may be added to concrete at job site, not to exceed the design water content, subject to the limitations specified in ASTM C94/C94M. If additional slump is required, use water reducing admixture.
- C. Discharge Procedures:
 - 1. Discharge mixed concrete within 90 minutes after the introduction of mixing water to the cement and aggregates. Reduce this time to 45 minutes when the concrete temperature exceeds 85 degrees F. Contractor shall communicate to the concrete supplier the discharge time limit and take appropriate measures as required to maintain slump and concrete temperature limits with use of retarding or hydration control admixtures within the manufacturer's specified dosage limits.
 - a. Alternate proposed discharge time limits for mixed concrete discharge in accordance ASTM C94 shall be acceptable as follows.
 - 1) Submit proposed alternate to Architect for review.
 - 2) Contractor shall communicate to the concrete supplier the proposed discharge time limit.
 - 3) The discharge time limit shall consider the actual project conditions and projected transportation time at the time of concrete placement and take appropriate measures as specified in ACI SPEC-305.1 to maintain slump, temperature, and required compressive strength of concrete.
 - 4) The discharge time limit shall be indicated on the batch plant delivery ticket.
- D. Place concrete within 15 minutes after it has been discharged from the mixer. Handle concrete from mixer to forms in a continuous manner.
- E. Deposit concrete as close as possible to its final position in the forms, with no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized.
- F. Deposit concrete continuously or in 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 concrete cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- G. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic to avoid cold joints.

- H. Pumping concrete, when specifically accepted, may be conveyed by positive displacement pump such as piston or squeeze pressure type; pneumatic placing equipment is not permitted. Use rigid steel pipe or heavy-duty flexible hose with an inside diameter at least three times the nominal maximum-size coarse aggregate, but not less than 4 inches. Aluminum pipe is not allowed.
- I. Provide adequate scaffolding, ramps and walkways in a manner so that personnel and equipment are not supported by in-place reinforcement.
- J. Consolidation: Consolidate placed concrete with mechanical vibrating equipment per ACI SPEC-301.
 - 1. Consolidate each layer of concrete immediately after placing using internal vibrators, except for slabs 4 inches thick or less.
 - 2. Insert and withdraw vibrators vertically at uniformly spaced location no farther than the visible effectiveness of the vibrator. Hold vibrator stationary and slowly withdraw vertically while operating.
 - 3. Do not use vibrators to transport concrete inside forms.
 - 4. Place vibrator to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers that have begun to lose plasticity. Limit vibration duration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
- K. Concrete Slabs: Deposit and consolidate concrete for slabs in a continuous operation within limits of construction joints until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement 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. Slope exterior surfaces for drainage as directed, unless otherwise shown.
- L. Hot Weather Concreting: Place concrete according to ACI SPEC-305.1 and as follows:
 - 1. Cool components before mixing to maintain concrete temperature below 85 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature. Calculate and include water equivalent of ice in designed water cement ratio.
 - 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.
 - 4. Protect concrete from surface drying; moisture loss from concrete in plastic state shall be maintained below 0.1 pounds per square foot per hour. Methods may include, but are not limited to: evaporation retardant, sun shades, wind breaks, and fog misting.
- M. Cold Weather Concreting: Place concrete according to ACI SPEC-306.1 and as follows:
 - 1. Protect concrete work from physical damage or reduced strength as a result of frost, freezing, or low temperatures.

2. When ambient temperature is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 75 degrees F.
 3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade.
 4. Do not incorporate calcium chloride, salt or other materials containing antifreeze agents into the concrete mix.
 5. Upon Architect's written acceptance and subject to prior approval of mix design, accelerating admixtures, containing no calcium chloride, as specified in this Section may be used.
- N. Do not allow concrete overpour from formwork where underground products and systems need to be installed at or adjacent to the concrete work. If overpour occurs, remove as necessary to accommodate the installation of such items.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete, unless otherwise indicated on Drawings.
- B. Construction Joints: Locate and install joints as indicated on Drawings or as accepted by Architect, and in a manner that strength and appearance of concrete are not impaired.
1. Comply with ACI CODE-318.
 2. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
 3. Expose concrete aggregates, a minimum of 1/4 inch depth, creating a rough surface using a surface retardant. Within 24 hours after placing concrete, remove retarded surface mortar using either high pressure water jetting or stiff brushing or a combination of both to expose coarse aggregate. A rough surface of exposed aggregate may also be produced by sandblasting followed by high pressure water jetting.
 4. Where new concrete joins existing concrete (concrete more than 60 days old), clean and roughen existing concrete to expose coarse aggregate. Coat with epoxy bonding compound prior to placing new concrete.
 5. Waterstops:
 - a. Install waterstops in the longest lengths practicable where indicated. Use factory fabricated joints; field splices are acceptable in straight sections only.
 - b. Field butt splices shall be heat fused welded using a Teflon coated thermostatically controlled waterstop welding iron at approximately 380 degrees F. Follow approved waterstop manufacturer recommendations. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
 - c. Center waterstop in joint and secure waterstop in correct position using grommets, pre-punched holes, or hog rings (installed by others) spaced at 12 inches on center along the length of the waterstop and wire tie to adjacent reinforcing steel.
 6. Horizontal Joints: Apply a 1 inch wood grade strip, level and straight, 1/2 inch below the placement lift elevation for a neat joint.
- C. Slab-on-Ground Control Joints: Tool or saw-cut weakened plane joints at a depth of at least 1/4 slab thickness where shown on Drawings. Where not indicated in Drawings, provide at distances (in feet) every two times to three times of slab thickness (in inches).

1. Tooled Joint: Form control joints after initial floating by grooving and finishing each joint edge to a 1/8-inch radius. Repeat grooving after applying surface finish.
 2. Sawed Joint: Saw-cut 1/8-inch width as soon as the concrete has hardened sufficiently to prevent raveling (dislodging of the aggregates) of the edges of the saw-cut and completed before shrinkage stresses become sufficient to produce cracking.
 3. Fill control joints with polyurea joint filler in accordance with manufacturer's written installation instructions.
- D. Slab-on-Ground Expansion Joints and Isolation Joints: Provide expansion joints and isolation joints where shown on Drawings, where slab abuts vertical surfaces such as curbs, gutters, and sidewalks.
1. Extend joint-filler strips full width and extend to full depth of joint, terminating not less than 1/2 inch and not more than 1 inch from finish surface. Apply a removable capping flush to slab finish.
 2. Install strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
 3. Remove capping when concrete has cured and apply joint sealant.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where shown on Drawings.

3.5 FORMED SURFACES FINISHING

- A. Maintain uniform color of the concrete by using only one mixture without changes in material or proportions for any structure or portion of structure exposed to public view.
- B. Repair and patch tie holes. Apply cone hole plugs matching color of cured concrete; and unless otherwise indicated, flush to concrete surface, as provided by form tie manufacturer using waterproof adhesive.
1. Acceptable Alternative: Cementitious repair mortar matching color of cured concrete; and unless otherwise indicated, flush to concrete surface.

3.6 CONCRETE SLABS FINISHING

- A. Comply with ACI PRC-302.2 and as specified in this Section. Comply with flatness and levelness tolerance requirements of this Section.
- B. Concrete slabs that will remain exposed in finished construction shall be uniform in color and free from visual blemishes.
- C. Float Finish:
1. Immediately following placing and consolidating concrete, begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface.
 2. When concrete has sufficiently stiffened begin floating to a true and even plane free of ridges. Perform floating using power-driven equipment or hand floats if area is small or inaccessible to power-driven floats.
 3. If bleedwater is present prior to finishing, carefully drag-off or remove by absorption with porous materials such as burlap. Dusting of surfaces with dry cement or other materials or the addition of any water during finishing is not permitted.

4. Check slab surfaces with a 10-foot straightedge at regular intervals while concrete is still plastic, to detect high or low areas.
5. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighten until surface is left with a uniform, smooth, granular texture.
6. Take extreme care during finishing operations to prevent over finishing or to prevent working water into the surface; this can cause crazing (surface shrinkage cracks which appear after hardening) of the surface. Slabs with surfaces exhibiting significant crazing as determined by Architect shall be removed and replaced.

D. Broom Finish:

1. After floating, lightly trowel surface and then carefully score by pulling a broom across the surface. Use appropriate type of broom to achieve texture specified.
2. Broom as indicated or as directed by Architect. Where not specifically indicated, broom transverse to traffic or at right angles to the slope of the slab.
3. Adding water to facilitate brooming is not permitted.
4. Exterior ramps, walks, and slabs: Apply a slip-resistant finish as follows:
 - a. Where slope is 6 percent or greater: Heavy broom finish with at least 0.8 coefficient of friction per ASTM E303.
 - b. Where slope is less than 6 percent: Medium broom finish with a minimum 0.6 coefficient of friction per ASTM E303.

E. Slab Flatness and Levelness Tolerance: Determine flatness and levelness of slabs using the F-Number System in accordance with ASTM E1155 using the inch-pound system of units. Calculate F-Numbers as follows:

1. Definitions:
 - a. Face Flatness Number (F_F): The maximum slab curvature allowed over 24 inches computed on the basis of successive 12 inch elevation differentials.
 - b. Face Levelness Number (F_L): The relative conformity of the slab surface to a horizontal plane as measured over a 10 foot distance.
2. Sampling Requirements: As described in ACI SPEC-117.
3. Calculations:

$$F_F = \frac{4.57}{\text{Maximum difference in elevation (in decimals of inches) between successive 12 inch elevation differences.}}$$

$$F_L = \frac{12.5}{\text{Maximum difference in elevation (in decimals of inches) between two points 10 feet apart.}}$$

4. Tolerances, unless noted otherwise:
 - a. Float finish surfaces on ground: F_F 20; F_L 17 (overall tolerance values).
5. Refer to Article 3.9 of this Section for remedial work required for out-of-tolerance concrete.

F. Site Concrete Flatness Tolerance: Refer to Section 32 13 13.

1. Surface cross slopes shall not exceed one unit vertical in 50 units horizontal (2 percent).
2. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Section 11B-302 and Section 11B-403.

3.7 CURING AND PROTECTION

A. Protect freshly placed concrete from premature drying, rapid temperature change, mechanical injury, and injury from flowing water for a curing period not less than 7 days. Comply with ACI SPEC-306.1 for cold-weather protection and ACI SPEC-305.1 for hot-weather protection during curing.

B. Curing Methods:

1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written installation instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. If curing compound is applied using a hand held, pump-up sprayer, it shall be back-rolled using a short nap roller.
2. Moist Curing: Keep surfaces in a moist condition for not less than 7 days using water saturated absorptive cover (burlap-polyethylene sheeting) kept wet continuously. Cover concrete completely in widest practicable width, with sides and ends lapped at least 12 inches, and sealed with waterproof tape or adhesive. Immediately repair and maintain rips and tears and keep traffic away from surface during curing period.
3. Ponding or Immersion: Continuously immerse concrete throughout the curing period in water not more than 20 degrees below the temperature of the concrete.

C. Concrete in Forms: Keep forms and exposed concrete surfaces covered and continuously moist. Provide soaker hoses at top of walls or other accepted means of keeping concrete and forms wet while forms remain in place. If forms are removed before end of curing period, continue curing by methods described in this Section.

D. Slabs:

1. Evaporation Retarder: Apply evaporation retarder to slabs if hot, dry, or windy conditions cause moisture loss of 0.1 pounds per square foot per hour before and during finishing operations. Apply according to manufacturer's written installation instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
2. Cure by application of curing and sealing compound or by moist curing.
3. Begin curing as soon as free water has disappeared from the concrete surface after placing and final finishing.

E. Protection:

1. Protect concrete surfaces from damage by tools, equipment, materials, and construction activity.
2. Traffic, shoring, or loading will not be permitted on concrete surface until it has sufficiently hardened to prevent injury to finish and strength.
3. Protect all flat work and other surfaces as required with full board of plywood coverings as necessary.

3.8 REMOVAL OF FORMS

- A. Formwork for sides of curbs and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete provided concrete is hard enough not to be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork for slabs, and other structural elements that supports weight of concrete in place until concrete has achieved the following:
 - 1. At least 100 percent of 56-day design compressive strength.
 - 2. At least 70 percent of 56-day design compressive strength when shores have been arranged to permit removal of forms without loosening or disturbing shores.
 - 3. Determine compressive strength of in-place concrete by testing representative field or laboratory-cured test specimens according to ACI SPEC-301.

3.9 CONCRETE REPAIRS

- A. General: Comply with ACI SPEC-301 as follows:
 - 1. Completed concrete work shall conform to applicable requirements of this Section and Contract Documents.
 - 2. Concrete work that fails to meet one or more requirements of the Contract Documents but subsequently is repaired to bring the concrete into compliance will be acceptable.
 - 3. Concrete work that fails to meet one or more requirements of the Contract Documents and cannot be brought into compliance with the Contract Documents is subject to rejection.
 - 4. Repair rejected concrete work by removing and replacing or by additional construction to strengthen or otherwise satisfy project requirements as directed by Architect. To bring rejected Work into compliance, use repair methods that meet applicable requirements for function, durability, dimensional tolerances, and appearance as determined by Architect.
 - 5. Submit proposed repair methods, materials, and modifications needed to repair concrete work to meet the requirements of the Contract Documents.
 - 6. Contractor shall be responsible to bring concrete work into compliance with requirements of Contract Documents.
- B. Defective Concrete: Repair and patch defective concrete work and concrete not conforming to required lines, details, and elevations. Use materials and methods specified in this Section as accepted by Architect. Serious defects, defects affecting structural strength, or unsatisfactory patching may be cause for complete removal and replacement of concrete.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface stains, and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycomb, rock pockets, and voids more than 1/2 inch in any direction in solid concrete. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with drypack grout before bonding agent has dried. Fill form-tie voids with cementitious patching mortar or cone hole 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, repair mortar will match surrounding color. Patch a test area at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed, formed surfaces that affect concrete's durability and structural performance as determined by Architect and DSA.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness.
1. Repair defective finished surfaces including spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced section regardless of width, and other objectionable conditions.
 2. After concrete has cured 14 days, correct high spots by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish areas to blend into adjacent concrete.
 4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surface in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete. Place, compact, and finish to blend with adjacent finished concrete.
 5. Repair random cracks and single holes 1 inch or less in diameter with drypack grout. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place drypack grout before bonding agent has dried. Compact and finish grouted areas to match adjacent concrete.
- E. Moist cure patches and repairs for at least 72 hours.
- F. Perform concrete structural repairs subject to Architect's and DSA's acceptance.

3.10 FIELD QUALITY CONTROL

- A. General: Comply with requirements of Division 01.
- B. Testing Service: Owner will select and pay for independent testing agency.
- C. Strength Test Specimen Cylinders: Conduct sampling, curing, and testing per ASTM C172, ASTM C31/C31M, and ASTM C39/C39M. Contractor shall provide molds required for strength test cylinders. Test samples shall be taken at the point of concrete placement.
 1. Frequency: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 50 cubic yards of concrete, nor less than once for each 2000 square feet of surface area for slabs or walls. Additional samples for 7-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

2. A strength test shall be the average of the strengths of at least two 6 inch by 12 inch cylinders or at least three 4 inch by 8 inch cylinders made from the same sample of concrete and tested at the test age designated for the determination of concrete compressive strength.
 3. Cylinder Label and Records: Mark and date each test cylinder. Maintain records of test specimen cylinders and send copies to Contractor, Architect, DSA, Project Inspector, and Owner. Record the following information:
 - a. Cylinder identification mark.
 - b. Date made.
 - c. Concrete supplier.
 - d. Slump/slump flow.
 - e. Specified concrete design strength.
 - f. Pour location and type of structural member.
 - g. Compressive strength test date and age.
 - h. Admixtures added to concrete mix.
 4. Compressive Strength Tests: Test laboratory cured specimens at the following ages and report compressive strengths as follows:
 - a. 7 days at the start of use of each class of concrete or change in mix or aggregates.
 - b. Where early compressive strength test is required prior to loading.
 - c. 28 days Indicator test minimum one cylinder for concrete requiring a 56 days compressive strength.
 - d. 28 days or 56 days compressive strength test.
 - e. Hold one cylinder for compressive strength test in reserve.
 5. Test Reports: Furnish copies of test reports directly from testing agency to Contractor, Architect, DSA, Project Inspector, and Owner.
- D. Slump Test: ASTM C143/C143M. Conduct slump testing when test cylinders are made and additionally for every 150 cubic yards of concrete. Perform additional tests when concrete consistency appears to change. Slump not meeting slump indicated in accepted mix design (plus or minus 1 inch) will be rejected. Contractor shall provide slump cones.
- E. Density: ASTM C138/C138M. Conduct density testing when test cylinders are made.
- F. Concrete Temperature: ASTM C1064/C1064M. Check concrete temperature when test cylinders are made and every hour when ambient temperature is below 40 degrees F or above 90 degrees F.
- G. In the event the cylinders tested do not meet the required concrete design strength, conduct core tests and additional tests or inspections as may be required by Architect to ascertain strength of placed concrete. Costs for additional tests and inspections shall be borne by Contractor.
- H. Flatness/Levelness: Provide verification of Slab Flatness and Levelness as specified in this Section. Furnish copies of report directly from testing agency to Contractor, Architect, Project Inspector, and Owner.

END OF SECTION

Concrete Mixture Design Submittal Checklist

- ☐ Specify Use: All mix designs must clearly note the concrete type or use. (i.e. footings, slab on grade, site concrete).
- ☐ Mix Design: Provide concrete mixture designs with proportions and characteristics including all admixtures.
- ☐ Gradation: Provide combined aggregate gradation by weight for all course and fine aggregates.
- ☐ Weight: Provide dry unit weight of mix. Normal weight concrete shall be limited to 145 PCF.
- ☐ Material Certificates: Provide supplier's certification that materials conform to specifications. This includes aggregates, admixtures, and cementitious materials such as cement, fly ash, silica fume, slag cement, and metakaolin.
- ☐ Product Data: Provide product literature for each product and admixture used. Include manufacturer's specification, written installation instructions, and installation procedures.
- ☐ Required SCM: Mix design must contain the percentage of supplementary cementitious materials noted in mix design table of the specifications.
- ☐ Admixtures: Where multiple admixtures are used, provide a letter from all manufacturers indicating there are no compatibility problems or adverse effects resulting from combination of products.
- ☐ Shrinkage: Provide shrinkage test per modified ASTM C157/C157M at 21 days. Shrinkage test must be for the same mix specified or a similar mix with the same water cement ratio and aggregate source. (Exception: shrinkage testing is not required for below grade concrete).
- ☐ Testing/Proportion Method: Concrete must be proportioned per the requirements of ACI SPEC-301-20. Indicated method used and provide complete test data and documentation for the chosen proportion method.

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal fabrications at non-PC areas of work for the Project as follows:

1. Railing assemblies, exterior.
2. Stair safety nosings.
3. Miscellaneous metal fabrications.

1.2 RELATED SECTIONS

A. Section 09 91 00 – Painting.

1.3 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.

B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.

C. Referenced Standards:

1. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
4. ASTM A283/A283M – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
5. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
6. ASTM A312/A312M – Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
7. ASTM A513 – Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
8. ASTM A554 – Standard Specification for Welded Stainless Steel Mechanical Tubing.
9. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
10. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

11. ASTM E488	– Standard Test Methods for Strength of Anchors in Concrete Elements.
12. AWS A2.4	– Standard Symbols for Welding, Brazing, and Nondestructive Examination.
13. SSPC SP-2	– Surface Preparation Specification No. 2: Hand Tool Cleaning.
14. SSPC SP-6	– Joint Surface Preparation Standard SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings: For each item specified, indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- C. Product Data: Submit product data for each manufactured product specified by name and model number in this Section with the product and selected attributes clearly identified.
- D. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.5 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.
- B. Conform to 2025 California Building Code (CBC) Chapter 17A Special Inspections and Tests and Chapter 22A Steel.
 - 1. Materials:
 - a. Material Identification per CBC Chapter 22A, Section 2202A Structural Steel and Composite Structural Steel and Concrete.
 - 2. Inspection and Tests:
 - a. Welding Inspection per CBC Chapter 17A, Section 1705A, Paragraph 1705A.2, Steel Construction.
 - b. High Strength Bolt Inspection per CBC Chapter 17A, Section 1705A, Paragraph 1705A.2.1, Structural Steel and Table 1705A.2.1, Required Verification and Inspection of Steel Construction.
 - c. Non-Destructive Weld Testing per CBC Chapter 17A, Section 1705A, Paragraph 1705A.13.1, Structural Steel.
- C. Painting: Refer to Section 09 91 00 for field painting.
 - 1. Do not paint galvanized surfaces that are indicated to remain galvanized.

1.6 QUALIFICATIONS

- A. Welders' Certificates: Submit certificates under provisions of Division 01, certifying welders employed on the Work, verifying AWS qualification within the previous twelve months.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel: Unless otherwise noted, provide steel materials as follows:
 - 1. Steel Plates, Shapes, and Bars: ASTM A36/A36M and A572/A572M.
 - 2. Plates: ASTM A283/A283M.
 - 3. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation, structural quality.
 - 4. Pipe: ASTM A53/A53M, Type E or S, Grade B.
 - 5. Mechanical Tubing: ASTM A513, MT1010, Type 5, drawn over mandrel (DOM).
 - 6. Bolts, Nuts, and Washers: ASTM A307.
- B. Anchorage:
 - 1. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to 4 times the load imposed, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
 - 2. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.
- C. Welding Materials:
 - 1. Steel: AWS D1.1; type as required for materials being welded.
 - 2. Sheet Steel: AWS D1.3; type as required for materials being welded.
- D. Weld Filler Material: All weld filler material shall have a minimum tensile strength of 70 ksi per AWS D1.1, latest edition approved by code enforcement agency.
- E. Steel Shop and Touch-Up Primer: TNEMEC Series 115 Uni-Bond DF or accepted equal.
- F. Shop and Touch-Up Zinc Rich Primer for Galvanized Surfaces: ZRC Galviline Galvanizing Repair Compound as manufactured by ZRC Worldwide Company, Marshfield, MA; 800-831-3275, www.zrcworldwide.com, or accepted equal.

2.2 RAILING ASSEMBLIES

- A. Steel Railing Assemblies: Fabricated from steel pipe, steel plates and sections; sizes, and configurations as shown on Drawings. Hot-dip galvanize all components in accordance with ASTM A123/A123M, minimum 1.25 ounces per square foot.
 - 1. Steel Pipe: ASTM A53/A53M, Grade A, Schedule 40.
 - 2. Handrail Brackets: ASTM A36 steel bar, as indicated on Drawings.
 - 3. Galvanize handrail and guardrail assemblies after fabrication. After assembly has been galvanized, fill vent, and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

4. Perforated Metal Infill Panels: Item No. 16019211M1 as manufactured by McNichols or accepted equal, with the following characteristics:
 - a. Material: Carbon steel.
 - b. Thickness: 11 gauge; 0.1196 inch.
 - c. Hole Pattern: 1 inch diameter round holes on 1-1/4 inch 60 degree staggered centers.
 - d. Holes per Square Inch: 0.74.
 - e. Open Area: 58 percent.
 - f. Bar Width: 1/4 inch.
 - g. Straight Rows Parallel to: Length of Sheet.
 - h. Margins Parallel to Width: Minimum solid one side, sheared through other side.
 - i. Margins Parallel to Length: Sheared through both sides.
 - j. End Pattern: Sheared through both ends.
5. Finishes:
 - a. Handrails, guardrails, and fittings: Field painted in accordance with Section 09 91 00; color as selected by Architect.
 - b. Infill panels: Factory powdercoat finish in custom color as selected by Architect.
- B. Stainless Steel Tube Barrier at Drinking Fountain: Fabricated from stainless steel tubing, stainless steel plates, and sections; size as shown on Drawings.
 1. Stainless Steel Tubing: ASTM A554, Grade MT, Type 304, minimum wall thickness 0.156 inch.
 2. Stainless Steel Pipe: ASTM A312, Grade TP, Type 304.
 3. Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304.
 4. Finish: 320 grit polished and buffed.
- C. Fabrication:
 1. Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.
 2. Handrails shall not rotate in their fittings.

2.3 STAIR SAFETY NOSINGS

- A. Safety Nosing: Provide aluminum safety nosing with anti-slip abrasive finish.
 1. Basis of Design Product: Supergrit Safety Nosing, Type 231-BF with Sure-hold anchors by Wooster Products Inc., Wooster, OH; 800-321-4936, www.wooster-products.com; or accepted equal.
 2. Nosing Materials:
 - a. Type 6063-T5 extruded aluminum, with anti-slip abrasive filler containing approximately 65 percent virgin grain aluminum oxide (Al₂O₃) and silicon carbide abrasive.
 - b. Width: 3 inches.
 - c. Thickness: 1/4 inch.

- d. Length: Provide nosing for full width of treads less 1/8 inch on either side for clearance.
- e. The radius of curvature at the leading edge of the nosing shall be no greater than 1/2 inch.
- 3. Anchorage: Provide integral anchorage in nosing, as standard with manufacturer and acceptable to Architect.
- 4. Abrasive Filler Color: As selected by Architect from manufacturer's full range of standard colors.

2.4 MISCELLANEOUS METAL FABRICATIONS

- A. Provide miscellaneous metal fabrications as required to complete work under other Sections, but not specified in those Sections.

2.5 SHOP FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
 - 1. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Cut, drill, and punch metals cleanly and accurately. De-burr rough edges and holes.
- E. Form exposed work true to line and level with accurate angles and surfaces, and straight edges.
- F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication except where specifically noted otherwise.
- H. Miter and weld members, grind welds smooth.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 FINISHES

- A. All exposed exterior steel shall be galvanized after fabrication unless otherwise noted.
 - 1. Galvanizing shall be in accordance with ASTM A123/A123M, on designated steel items. Provide minimum 1.25 ounces per square foot galvanized coating.
 - 2. At galvanized members, touch-up all welds with zinc-rich primer or galvanizing repair paint.
- B. Painting where specified shall conform to applicable requirements of Section 09 91 00.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine job site conditions and verify field dimensions.
- B. Verify structure or substrate is plumb, level, and ready to receive work.
- C. Verify that appropriate backing, blocking, or structural reinforcing is provided at walls.
- D. Report unacceptable conditions to Architect. Begin installation only when unacceptable conditions have been corrected.

3.2 PREPARATION

- A. Supply items required to be cast into concrete with setting templates, to appropriate Sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Install manufactured items in accordance with manufacturer's written installation instructions.
- C. Allow for erection loads and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Field weld components indicated on shop drawings.
- E. Perform field welding in accordance with AWS D1.1 for steel and AWS D1.3 for sheet steel.
- F. Obtain Architect's acceptance prior to site cutting or making adjustments not scheduled.
- G. Install stair safety nosings on treads in accordance with manufacturer's written installation instructions and as indicated on Drawings. Accurately position and hold securely during placement of concrete. Terminate safety nosing as recommended by manufacturer.
- H. Post Setting in Concrete: Install support posts as indicated on Drawings.
 - 1. Cast-In Posts: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
 - 2. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch larger than outside diameter of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed, and placed to comply with anchoring material manufacturer's written installation instructions. In exterior locations top shall be smoothed and shaped to shed water.

3. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written installation instructions. In exterior locations, top shall be smoothed and shaped to shed water.

3.4 CLEANING

- A. Inspect components after completing installation. Remove dirt and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION

SECTION 07 13 26
SELF-ADHERING SHEET WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Self-adhesive elastomeric sheet membrane waterproofing for installation at below grade vertical surfaces.
- B. Drainage composite and protection board.
- C. Accessories.

1.2 RELATED SECTIONS

- A. Section 03 30 00 – Cast-In-Place Concrete.

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. ASTM D6135 – Standard Practice for Application of Self-Adhering Modified Bituminous Waterproofing.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Submit product data for each product specified in this Section with the product and selected attributes clearly identified.
- C. Manufacturer's Written Installation Instructions: Furnish manufacturer's written installation instructions for the installation of membranes, including procedures and materials for splicing and bonding.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Application shall be done only by an application firm normally engaged in this business and approved by the material manufacturers. All work shall be performed by qualified applicators working under an experienced supervisor.
- B. Manufacturer's Representation During Installation: A qualified representative of the membrane manufacturer shall be present periodically during the work on the waterproof membrane system to assure compliance with the specifications and recommendations of the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the job site in original unbroken packages bearing the manufacturer's label. Material shall be stored above the ground in a dry location. Containers shall be stored in such a manner as to prevent damage.
- B. Cover materials and store in dry condition between temperatures of 40 degrees F and 90 degrees F. Install within 1 year of date of manufacture. Do not store at elevated temperatures which will reduce the shelf life of the product.

1.7 JOB AND ENVIRONMENTAL CONDITIONS

- A. Job Conditions: The Membrane Waterproofing Contractor shall acquaint themselves with all conditions, general construction methods, and sequence to be employed. No extras will be permitted for his failure to do so.
- B. Environmental Conditions:
 - 1. Temperature: Surface temperature shall not be higher than 90 degrees F and no lower than 40 degrees F during application of membrane.
 - 2. Weather: Do not apply during periods of precipitation or when rain is expected for period of application, and for at least 3 hours following application.
 - 3. Ventilation: Provide positive ventilation to all areas not subject to natural ventilation during application and curing periods.

1.8 WARRANTY

- A. Membrane waterproofing products shall be warrantied for 5 years from the date of filing Notice of Completion against all defects in materials. Warranty shall also cover damage due to leaks, defective materials, and installation.
- B. Installer: Two year installer workmanship warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: GCP Applied Technologies, Products:
 - 1. Below Grade Vertical Surfaces: Bituthene 4000.
 - a. Drainage composite.
 - b. Protection board.
- B. Carlisle. Product:
 - 1. Below Grade Vertical Surfaces: CCW MiraDRI 860/861.
- C. W. R. Meadows. Product:
 - 1. Below Grade Vertical Surfaces: PRECON.
- D. Henry Company. Product:
 - 1. Below Grade Vertical Surfaces: Blueskin WP200.
- E. Substitutions: Under provisions of Division 01.

2.2 MATERIALS – BELOW GRADE VERTICAL SURFACES

- A. Elastic Sheet Membrane Waterproofing: 1.5 mm thick composite of rubberized asphalt and cross-laminated high density polyethylene carrier film.
- B. Surface Conditioner: Water based latex surface treatment, VOC compliant.
- C. Cant Strips: Formed from Bituthene Liquid Membrane.
- D. Protection Board: 1/4 inch thick, bitumen and mineral core between 2 reinforcing liners as manufactured by GCP Applied Technologies or accepted equal.
- E. Protection Board Adhesive: Bituthene protection board adhesive, fast-drying rubber-based cement.
- F. Prefabricated Drainage Composite: Hydroduct 220 for vertical applications, as manufactured by GCP Applied Technologies or accepted equal.
- G. Mastic Joint Sealant: Bituthene mastic, black rubberized asphalt mastic.
- H. Adhesive Tape: Bitustik Tape; aggressive 2-sided adhesive tape used for adhering prefabricated drainage composites to waterproofing membranes.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine surfaces to receive membrane waterproofing to assure that they are smooth, dry, and free of foreign material, moisture, and unevenness which would prevent the execution and quality of application of the membrane waterproofing as specified.
- B. Do not proceed with application of waterproofing systems until defects are corrected.

3.2 PREPARATION OF SURFACES – GENERAL

- A. Surfaces shall be dry, clean, smooth, and free from projections or holes that may cause puncture of membrane. Substrate shall be absolutely surface dry for proper adhesion of membrane. Minimum curing time for concrete shall be 7 days prior to membrane installation.
- B. Cleaning: Clean surfaces to remove all curing compounds, loose dirt, moisture, grease, dust, and other foreign material. Sweep or vacuum surface clean prior to membrane installation.

3.3 PREPARATION OF SURFACES – BELOW GRADE VERTICAL

- A. Concrete Construction Joints and Wall Cracks Over 1/16 Inch in Width: Fill with joint filler and sealant as required.
 - 1. Pre-strip all wall cracks over 1/16 inch wide and all construction and control joints with 12 inch wide sheet membrane strip.
 - 2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
 - 3. Repair bugholes over 1/2 inch in length and 1/4 inch deep and finish flush with surrounding surface.
 - 4. Remove scaling to sound, unaffected concrete, and repair exposed area.
 - 5. Grind irregular construction joints to suitable flush surface.

3.4 APPLICATION OF MEMBRANE – AT BELOW GRADE VERTICAL SURFACES

- A. Install membrane per ASTM D6135 and manufacturer's recommendations.
 - 1. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.
 - 2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.
 - 3. Seal daily terminations with troweled bead of mastic.
 - 4. Install drainage composite, protection board, and related materials in accordance with manufacturer's recommendations.
 - 5. The waterproofing membrane shall be covered as soon as possible after installation.

3.5 CLEAN-UP

- A. At the completion of the work of this Section, all surfaces and areas adjoining the membrane shall be left in a clean condition. All cartons, pails and equipment shall be removed from the premises.
- B. Clean any stains on materials that would be exposed in the completed work.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. BHMA finish door hardware for hollow metal doors and gates.
- B. Accessories including but not limited to door stops, kickplates.
- C. Weatherstripping, seals, and thresholds.

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- A. Hardware templates for doors, frames, and gates.

1.3 RELATED SECTIONS

- A. Summary of Work: Division 01, applicable Sections.
- B. Swinging Gates: Division 05 and/or Division 32 Metal Fabrications, applicable Sections including, but not limited to, ornamental, wood, and/or chain link gates.
- C. Section 07 92 00 – Joint Sealants.
- D. Section 08 11 13 – Hollow Metal Doors and Frames.
- E. Section 32 31 13 – Chain Link Fences and Gates.

1.4 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only.
 - 1. Refer to Division 01 for definitions, acronyms, and abbreviations.
 - 2. Unless otherwise noted; standards, manuals, and codes refer to the latest edition as of the issue date of this Project Manual.
- B. Conform to the following Referenced Standards and Requirements:
 - 1. CBC – 2025 California Building Code.
 - 2. ADA – Americans with Disabilities Act.
 - 3. NFPA 101 – Life Safety Code.
 - 4. ANSI A156 Series – Builders Hardware Manufacturers Association (BHMA) Standards Set.
- C. Conform to the following Regulatory Requirements (CBC – 2025 California Building Code):
 - 1. Doors / Doorways as part of an accessible route shall comply with CBC Section 11B-404.
 - 2. All hardware for accessible doors shall meet the requirements of CBC Sections 11B-404.2.7, 11B-404.2.9, and 1010.1.9.1.
 - 3. The clear opening width for a door shall be 32 inches minimum. The swinging doors it shall be measured between the face of the door and the frame stop, with the door open

- 90 degrees.
- a. There shall be no projections into it below 34 inches above finish floor and 4 inch maximum projections into it between 34 inches and 80 inches above finish floor or ground.
 - b. Door closers and stops shall be permitted to be 78 inches minimum above finish floor or ground per CBC Section 11B-404.2.3.2.
4. Hand-activated door opening hardware, handles, pulls, latches, locks, and other operating devices on accessible doors:
- a. Shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.
 - b. Lever hardware shall be so mounted / centered between 34 inches and 44 inches above finished floor or ground.
 - c. Hardware for door handles, pulls, latches, locks and other operating devices for use on means of egress doors shall comply with SFM Standard 12-10-2, Section 12-10-202 as contained in CCR Title 24, Part 12.
5. The force for pushing or pulling a door open shall be as follows per CBC Section 11B-404.2.9:
- a. Interior hinged doors, sliding or folding doors and exterior hinged doors operating force required to push or pull open a door shall not exceed 5 pounds.
 - 1) These forces do not apply with to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
 - b. The force required to activate any operable parts, such as retracting latch bolts or disengaging other devices, shall be no greater than 5 pounds to comply with CBC Section 11B-309.4.
 - c. Forces shall be applied to the latch side of the door per CBC Section 1010.1.3.1.
6. Door closing speeds shall be as follows per CBC Section 11B-404.2.8:
- a. Mount door closers for maximum swing of door before setting stops.
 - b. Doors/gates closers, when provided, shall have sweep period adjusted: minimum of 5 seconds for a door/gate to close from the 90 degree position to the 12 degree position.
 - c. Doors/gates with spring hinges require a minimum of 1.5 seconds to close from the 70 degree to the closed position.
7. Floor stops shall not be located in the path of travel and 4 inches maximum from walls.

1.5 QUALITY ASSURANCE

A. Supplier Qualifications and Documentation:

1. A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing school projects of this size and scope in the Northern California for a period of not less than five years. The firm shall employ (or consult with) an architectural hardware consultant (or someone of equal qualifications) who is available at reasonable times during the course of the project, for consultation regarding the project's hardware requirements, to the District, architect, and contractor. The firm shall have extensive field experience solving hands-on solutions to field problems. They must be able to demonstrate the ability to successfully complete a school project of this type.

B. Manufacturer of Submitted Devices - Qualifications and Documentation:

1. Manufacturer Qualifications: Manufacturer specializing in manufacturing institutional and commercial door hardware with a minimum five years with the following documented experience. Furnish list of at least ten past, finished projects. Include date completed, project location, and references. Past project contact information will determine if Builders Hardware is acceptable.

C. Installer of Submitted Devices - Qualifications and Documentation:

1. Installer of assembly shall be trained in the trade of hanging commercial doors on commercial frames with commercial hardware. Supplier and Installer of door assemblies shall be authorized representative of manufacturers and have minimum of five years successful experience in detailing, supplying, and installing door assemblies specified on projects of similar size, complexity, and type to this Project. Provide written documentation to show closers will be installed by an individual with successful experience installing closers to meet 5-pound opening force for non-rated door complexity.

1.6 SUBMITTALS

- A. The hardware groups/sets specified in Section 08 71 00 - Part 3 are intended to establish type and design standard when used together with the requirements of this Section, Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections. Examine Contract Documents and furnish proper hardware for door openings. Refer to specifications for clarification and detailed requirements and provide products and services in specifications even if not written in hardware groups/sets in Section 08 71 00 - Part 3.

- B. For each opening submit coordinated (means and methods) requirements in accordance with Division 01 and a detailed door, frame and hardware schedule. See pre-hardware and hardware scheduling requirements below. Submittals that do not meet means and methods, including missing related doors/frames submittal/shop drawings, will be returned for correction before checking.

C. Pre-Hardware Scheduling Tasks:

1. Coordinate work of this Section with other directly affected Sections and scope.
2. Provide required Division 08, means and method type work in accordance with Contract Documents at no additional cost to project, including Division 01 and language below. This Section supplier shall be provided with full documents, not just Section 08 71 00 Part 3 hardware group/sets as that process does not meet Contract requirements.
3. Means and method type work includes, but is not limited to, coordination with plans and other specifications, templating, Section 08 71 00, and other Division 08 Section engineering and coordination. Starting submittal work or labor before means and method type work is completed does not constitute change orders.
4. Provide RFIs (request for information) for clarification items before submittals. This Section is not to be a stand-alone submittal but requires multiple Sections and Drawings coordination before submittals will be reviewed.
 - a. Coordinate length and sizes for hardware devices before submittals, Verify the door hardware is compatible for use with the doors and door/frames.
 - b. Report all prevailing conditions that will adversely affect satisfactory execution of work before submittals.

- 1) Example 1: If door stiles would inhibit the use of specified hardware, provide RFIs before starting detailed hardware headings or group submittal process.
- 2) Example 2: Coordinate length and sizes for hardware devices before ordering materials (verify the door hardware is compatible for use with the doors and/or door/frames) including, but not limited to, special templates and sizes of devices.
- c. This Section clarification items (RFIs) shall be reviewed by a non-design team coordinator before sending to design team for review.
 - 1) For clarification items that are means and methods (directed to or from one vendor to another vendor, framer/installer), Contractor shall coordinate and answer or list questions that are not design scope.
5. Multiple submittals for this Section work will not meet Contract requirements. Exceptions are as follows:
 - a. Submittals may be broken up into different door vendor packages (for example: one glazing vendor package, one hollow metal and wood door vendor package, one non-rated aluminum/storefront vendor package, one gate vendor package, one auto operator vendor), but breaking each of these packages into multiple or separate packages is not permissible (example: separate project buildings or different floors broken out not permitted).
 - b. Frames that are required to be ordered early in the build process (under ten frames / openings required to meet project deadlines for early site work) may be broken into separate packages but remaining hardware in these packages will be rejected and not reviewed.
6. Coordinate with door/frame internal reinforcement for door hardware. In particular, coordinate door preparation in accordance with applicable regulatory and trade standards specified.
7. Coordinate keying requirements with all openings with one Vendor. For keying scope, even if different Section door/frame/gate scope packages are submitted with different hardware schedule submittals, only one Section 08 71 00 supplier is to oversee, coordinate, submit, furnish, and install keying. Coordinate per Section 08 71 00 and per means and methods before submits begin.

D. Hardware Schedule:

1. Submit required vendor qualification letters and documentation (see above "QUALITY ASSURANCE").
2. Non-design team coordination and requirements:
 - a. Submittals for coordinated door/frame/hardware items, shall be submitted at the same time for review of total opening requirements. Do not submit Section 08 71 00 scope without coordinated door and frame packages and above RFI/clarification process tasks completed. Submittals that do not include related doors/frames will be returned for correction before checking.
 - b. Section submittals and/or shop drawings to be reviewed and have comments by non-design team (Contractor) before sending to design team. If submittals do not meet Contract requirements, return to hardware vendor for re-submittal. In many cases, unacceptable submittals are passed though without non-design team (Contractor) comments (coordinate per Contract).
3. Submit hard copies of hardware schedule (number of copies per Division 01) as well as submit editable, PDF files via electronic email of ftp site process in Vertical Format as

illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Horizontal-type schedules will be returned for correction before reviewing.

- a. Shop drawings / hardware schedule shall clearly indicate each hardware group specified and manufacturer of each item proposed as well as each door number that the hardware is assigned to.
- b. Vertical schedule format sample:

Heading Number 1 (Door Schedule or Architectural Assigned Hardware Group/Set number from part 3 = HW # __)				
1 Single Door #1 - Exterior from Corridor 101		Opening Size	90°	RH
Quantity	Device Description	Device # (include specification language)	Finish	Manu- facturer
4	Hinges	4.5 x 4.5 NRP x fasteners	630	
1	Lockset		630	SC
1	I/C Cylinders	Rim or Mortise x appropriate cam x blocking rings as required (rim or mortise type and quantity as required by locking device)	626	
1	Permanent Core		626	
1	Door Silencers	SR64 or SR65 (as required)	GR	IV

4. Illustrations from manufacturer's catalogs and product data:
 - a. Provide cut sheets and product data with vertical format hardware submittal (same timeframe) as well as door and frame information to be reviewed as one submittal package. Manufacturer's hard copy as well as PDF catalog cut sheets and product data shall not be submitted before editable, PDF files vertical format hardware submittal. See above Sequence of Format requirement. Catalog cut sheets and product data sent as submittals before the typed-out nomenclature of hardware part numbers (vertical format hardware submittal) will be returned without review.
5. Provide hardware schedule and hardware templates to door and frame manufacturer. Provide two templates to those manufacturers who are not currently registered template book holders.

E. Vendor meetings or coordination prior to purchasing materials:

1. Convene coordination meeting between all opening vendors and installers at least two weeks prior to purchasing doors, frames, door hardware, and electrical devices required for complete systems. Attendance includes but is not limited to hardware supplier and/or installer, door supplier and/or installer, frame supplier and/or installer, auto operator vendor and/or installer, security card reader vendor and/or installer, and electrical. If hardware changes are required due to these meetings, communicate changes to design team before ordering materials.

F. Templates:

1. Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.
2. Submit templates and "Reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

G. Installation Instructions:

1. Provide manufacturer's written installation and adjustment instructions for finish hardware.
2. Send installation instructions to site with hardware.

H. Contract Closeout Submittals: Include specific requirements indicated below.

1. Operating and maintenance manuals: Submit three sets containing the following:
 - a. Complete information in care, maintenance, and adjustment, data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - e. Copy of final accepted hardware schedule, edited to reflect "As installed".
 - f. Copy of final keying schedule.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Division 01.
- B. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- C. Storage: Store materials in a cool and dry location, elevated from the ground and protected from the elements, and secured from theft or pilferage.

1.8 WARRANTY

- A. Comply with provisions of Division 01.
- B. Warranty installed units shall be free from defects in material and workmanship as follows:
 1. Hinges: Lifetime Warranty (Life of Building).
 2. Locksets and Exit Devices: Three years.
 3. All Other Hardware: Two years.

1.9 MAINTENANCE

- A. Provide special wrenches and tools applicable to each special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware manufacturer.

PART 2 PRODUCTS

2.1 FINISHES

A. Typical BHMA finish designation references:

1. Typical BHMA finish designation references:

- a. BHMA 626 – Satin chromium plated brass or bronze.
- b. BHMA 628 – Satin or dull aluminum, clear anodized (uncoated).
- c. BHMA 630 – Satin stainless steel.

2. Closers:

- a. BHMA 689 – Sprayed aluminum paint finish (back of house where specified).

3. Nomenclature and specifications for antimicrobial finish as shown in hardware groups/sets (Part 3 below):

- a. Antimicrobial Finish nomenclature example: Healthy Hardware™ antimicrobial surface or Antimicrobial finish nomenclature example: BHMA 626MA antimicrobial finish.
- b. Provide antimicrobial finish that is an FDA recognized, antimicrobial coating with built in protection to prevent the growth of a broad range of bacteria, mold, and mildew.
- c. Provide full warranty of locking manufacturer and other devices in both 630 and 626 base finishes with added antimicrobial finish.

2.2 HARDWARE TEMPLATE

A. Make templates for hardware to be applied to metal doors or pre-finished doors.

B. Hinge templates shall conform to ANSI A156.7.

C. Promptly furnish template information or templates to door and frame manufacturers.

D. Coordinate hardware items to prevent interference with each other.

2.3 SCREWS, BOLTS, AND FASTENING DEVICES

A. All exposed fasteners to be stainless steel or zinc plated.

B. Exposed head oval phillips type screws in countersunk holes unless otherwise specified. Use screws, bolts, washers, grommets, nuts, and other fastening devices of appropriate length, type, head, metal, and finish as necessary for proper match and application of hardware.

2.4 SUBSTITUTIONS

A. Products referenced by specific brand names and model numbers have been identified by District to match other products in use either completed or in the course of completion. No substitutions permitted per Public Contract Code Section 3400.

1. Otherwise refer to Division 01 for substitutions.

2.5 HANGING HARDWARE

A. Butt Hinges:

1. Acceptable Manufacturers:

- a. McKinney Products Co.

- b. Ives Manufacturing by Allegion.
 - c. Stanley Works.
 - d. Hager Manufacturing.
2. Where hardware groups/sets have different information (number of hinges and sizing), refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device.
- a. Butt hinges shall be manufactured in accordance with ANSI/BHMA A156.1.
 - b. Provide wide throw hinges where required:
 - 1) Submit and provide hinge widths sufficient to clear trim projection when door swings 180 degrees. All doors shall swing 180 degrees if wall allows.
 - 2) Utilize wide throw type hinges to clear frame or wall obstructions/cladding in order for doors to completely open. See 180-degree language above.
 - 3) Where a door closer device is specified and will be installed on pull side/hinged side of doors (i.e. closers will hit walls or other surfaces when door is completely open), provide wide throw type hinges to give sufficient pocket depth to hide closer behind door. Do not pinch or crush closer between the door and wall surface.
 - 4) Confirm hinge sizing with frame and wall details.
 - c. Provide "weight/strength" as specified in hardware groups/sets in Part 3 (hinge nomenclature basis-of-design weight/strength).
 - d. For doors 1-3/4 inches thick and up to 36 inches wide, provide hinge height of 4-1/2 inches.
 - e. For doors 1-3/4 inches thick and 37 inches to 48 inches wide, provide heavy duty, four ball bearing hinges and height of 5 inches.
 - f. If hardware sets specify height (example: 5 inches tall at 36 inch wide door), provide height as specified for project standards at these locations.
 - g. Provide two butts for doors up to 60 inches high and one additional butt for each 30 inches of height or fraction thereof.
 - h. Provide non-removable pins at exterior doors.
 - i. Provide ball-bearing hinges. Non-ball-bearing hinges are not acceptable.
- B. Gate Hanging Devices:
1. Ornamental and Steel Gate Self-Closing Hinges:
- a. Acceptable Manufacturers:
 - 1) Locinox Manufacturing (no known equal).
 - b. Mammoth 180-Degree Hydraulic Closers/Hinges Set.
 - c. Heavy duty full surface mounted hinge and vertical built-in closer not exceed 5 pounds opening force.
2. High Capacity Precision Engineered (heavy duty) hinges:
- a. CBI-8500 series hinges by Crown Industrial, South San Francisco, CA; (650) 952-5150; <http://www.crown-industrial.com/>, or accepted equal.
 - b. Provide additional number of offset hinge devices to meet hinge manufacturer device warranty and gate warranty.
 - c. Confirm hinge sizing with frame details. All doors shall swing 180 degrees if opening

will allow. Provide wide throw hinges where required (provide widths sufficient to clear trim projection when door swings 180 degrees).

- d. Provide non-removable pins.
- 3. Gate hinges shall be mounted and welded in accordance with manufacturer's recommendations.
 - a. Coordinate with welding requirements in Contact Documents.
 - b. Provide devices ground smooth and painted to match gate/fence system – see Section 09 91 00 for paint and primer requirements.
- 4. Products by the following manufacturers will be considered for acceptance providing all specified criteria have been met in full. Furnish all items and components of hardware required to complete the work in accordance with specifications, Contract Documents, and intended operation.
 - a. Ameristar.
 - b. Monumental Iron Works.

2.6 SECURING DEVICES (LATCHING SYSTEMS)

A. Cylindrical Locksets and Latchsets:

- 1. Acceptable Manufacturers:
 - a. Schlage Lock Co. ND Series.
 - b. District's standard, no substitutions permitted.
- 2. Levers:
 - a. Provide levers to return to door within 1/2 inch. Levers that have return to door within 1/2 inch to meet California State Fire Marshal mandates: no space/gap greater than 1/2 inch between face of door and lever return.
 - b. Lever Style: Traditional Square Style RHO.
 - 1) Provide exterior side lever trim with vandal resistant feature. Locked exterior lever freely rotates withstanding abuse and vandalism while remaining securely locked. Example: Schlage ND series Vandlgard™.
- 3. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. Cylindrical locksets shall be a BHMA Certified Product, meeting requirements per ANSI A156.2, 1996.
 - b. Backsets: 2-3/4 inches.
 - c. Strikes:
 - 1) Provide ANSI 4-7/8 inch standard strike.
 - 2) Provide curved lip-type strike at all locations if possible to prevent catching clothing or other objects on strike. Where required, provide detail and flat strike.
 - 3) Where required, provide extended lip strike so that the lock or latchset latch will not come in contact with frame or added trim on or adjacent to the frame. Example: Don Jo device #MEST-104, but provide submitted manufacturer equivalent extended lip strike.

B. Mortise Locksets, Latchsets:

1. Acceptable Manufacturers:
 - a. Schlage Lock Co. L9000 Series.
 - b. District's standard, no substitutions permitted.
2. Levers:
 - a. Provide levers to return to door within 1/2 inch.
3. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. Locksets shall meet the requirements of ANSI/BHMA A156.13-1994, Operational Grade 1.
 - b. Provide only thumbturn devices that meet accessibility requirements. Example: Schlage #09-509 x L583-363 devices. No center pivoting thumbturns allowed.
 - c. Provide thumbturn devices that meet accessibility requirements (no center pivoting thumbturns allowed). Example: Schlage thumbturn #09-509 x L583-363 device.
 - d. If deadbolts or lockbolts are utilized on the project, devices shall be interconnected with the latching mechanism on all egress doors to provide single movement function to unlatch doors.
 - e. Backset: 2-3/4 inches. Provide minimum 1 inch throw stainless steel deadbolt Provide minimum 3/4 inch throw for latch bolt.
 - f. Strikes:
 - 1) Provide ANSI 4-7/8 inch standard strike.
 - 2) Provide curved lip-type strike at all locations if possible to prevent catching clothing or other objects on strike. Where required, provide detail and flat strike.
 - 3) Where required, provide extended lip strike so that the lock or latchset latch will not come in contact with frame or added trim on or adjacent to the frame. Example: Don Jo device #MEST-104, but provide submitted manufacturer equivalent extended lip strike.

C. Flush Bolts and Dust Proof Strikes:

1. Acceptable Manufacturers:
 - a. Ives Manufacturing.
 - b. Triangle Brass Manufacturing Company, Inc. (Trimco).
 - c. Rockwood.
 - d. Hager Manufacturing.
2. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:
 - a. Non-rated Openings: Where not specified in hardware sets, provide two flush bolts for inactive leaf of pairs of locked and latched doors. Locate centerline of top bolt not more than 78 inches from finished floor. Provide dustproof strike for bottom bolts, type as required for floor condition.

2.7 KEY SYSTEMS (CYLINDERS, CORES, AND KEYS)

A. Key Systems (Cylinders, Cores, and Keys):

1. Manufacturers:
 - a. Schlage Keying manufacturing.
2. For all locking or dogging devices, provide complete keying system whether or not specified in Section 08 71 00, Part 3 hardware sets including lock cores, mortise cylinders, and rim cylinders keyed as directed by District in submittal process. Key System shall be:
 - a. Patented Schlage Primus Level 3 Keyway.
3. Keyway: Provide as instructed by District during submittal process.

B. Keying Requirements:

1. Provide keyed, construction cores and keys during the construction period.
 - a. Provide full sized cylinders or brass construction cores and brass keys at all interior and exterior doors. Plastic cores are not permitted.
 - b. Construction control and operating keys and core shall not be part of the District's permanent keying system or furnished in the same keyway or key section as the District's permanent keying system. Permanent cores and keys prepared according to the accepted keying schedule shall be furnished to the District.
2. Keying Meeting and Programming Schedule:
 - a. Do not provide keying matrix in original hardware submittals. After hardware has been submitted and reviewed in accordance with Division 01 and Section 087100 requirements, arrange a keying matrix/programming meeting with District Representative and the project hardware suppliers/vendors that is certified to assist the District Representative in developing cylinders/keying system based on reviewed submittals per below (contract with a certified hardware suppliers/vendors/locksmith to perform the following tasks without the design team or design consultants input (keying meetings require confidentiality with no one outside these meetings knowing the city keying system)).
 - 1) Copies of all plans (pages with door or gate numbers on them) shall be brought to the meeting with card reader and keyed doors highlighted for review (Contractor scope). After the meeting, provide the District Representative with both a scanned digital/PDF copy of the marked up plans, as well as the original copies of the plans delivered to the City with meeting notes.
 - 2) Copies of all reviewed door, frame, gate and hardware submittals shall be brought to the meeting with card reader and keyed doors highlighted for review (do not use the original specifications for keying meeting). After the meeting, provide the District Representative with both a scanned digital/PDF copy of any hardware submittal pages that have mark ups, as well as the original copies of the meeting's hardware submittal pages delivered to the District's Representative with meeting notes.
 - 3) Follow procedures for keying meeting and programming schedule as outlined by the Door Hardware Institute. DHI procedures are based on Door Hardware Institute core class entitled Masterkeying class #AHC200.
 - b. Keying meeting to produce a programming schedule/matrix based on the following:
 - 1) Furnish keys in the following quantities (total quantity of keys part of bid package):
 - a) 5 each Grand master-keys per set.

- b) 6 each Masterkeys per set.
- c) 3 each Change keys each lock, core or cylinder.
- d) 5 each Permanent Extractor keys.
- e) 9 each Construction masterkeys.
- f) 2 each Construction Core Extractor keys.
- 2) Provide keying system expansion parameters.
 - a) Plan twenty changes directly under the grand.
 - b) Plan ten master keys.
 - c) Plan fifty changes each for each master.
- 3) Permanent keys and cores shall be stamped with the applicable key mark for identification. The visual key control marks or codes shall not include the actual key cuts.
- 4) Permanent keys shall be stamped "Do Not Duplicate".
- c. Furnish typed programming meeting notes in PDF, editable electronic format as well as mailed, hard copy to District Representative (see above required PDF and hard-copy requirements).
- d. Transmit pinned cores/cylinders as well as cut grand masterkeys, masterkeys, change keys and other security keys to District Representative by Registered Mail, return receipt requested. All permanent cores and keys shall be sent directly from the factory to the District Representative for ID and verification.
- 3. Accompany District Representative to install permanent cylinders and/or cores:
 - a. In above keying meeting, plan time to accompany District Representative/assist the installation process of permanent cores in contracted permanent locking or keying housings.
 - b. District Representative and Contractor to agree on timeline when District Representative will have their completed pinned cores ready for installation.
 - c. Contractor responsible to prepare locking systems, installation ready for final cores, free from dirt, debris or overtightening of locking devices that may cause binding of keyed devices).
 - d. On project walk to assist in permanent core install, Contractor responsible to un-install construction cores (construction core devices are Contractor purchased and Contractor could keep or dispose of non-security construction cores).
 - e. Provide instructions for adjustments and maintenance of hardware and hardware finishes.
- C. Fire Control Key Boxes/Product: Rapid Entry System:
 - 1. Manufacturer and Product:
 - a. Knox Box 3200 Series x The Knox Co.
 - b. Or equal.
 - 2. Recessed mount, UL-listed, heavy-duty unit; fabricate from 1/4-inch-thick steel plate.
 - 3. Provide with restricted keying as required by Local Fire Department.

2.8 CLOSING DEVICES

A. Surface Mounted Closers:

1. Rack and Pinion Manufacturers:

- a. LCN Manufacturing: 4040XP as scheduled.
- b. District's standard, no substitutions permitted.

B. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:

1. ANSI A156.4, Grade 1; UL Listed.
2. Closers shall have multi-size spring power adjustment to permit setting of spring from 1 through 6 with additional spring power available. Provide access compliant setting nomenclature during submittals as recommended by closer manufacturer.
3. Submit correct closer type as to be able to install closers on non-public side of doors. Examples include but are not limited to 1) interior side of storage/electrical type rooms; 2) not in corridors/public areas 3) stair side of stairway doors; and at exterior locations, install closers inside of building (in conditioned spaces).
4. Installation Plates, Brackets, and Miscellaneous Adapters:
 - a. Furnished and installed all door closers with thru bolts.
 - b. Provide drop plates, brackets, or adapters for arms as required to suit details and install as directed by manufacturer's templates.
 - 1) Furnish and install drop plates at reverse bevel doors and at doors with 170 degrees to 180 degrees swing.
 - 2) Furnish and install blade, angle or applied stops as required where frame does not permit installation of the standard soffit plate. See example LCN #419 Flush Panel Adapter to be shown in submittals below. If LCN or equal manufacturer #419 Flush Panel Adapter is not in submittals as required for transom panel applications or if other drop plates, blade, angle or applied stops are not in submittals, the submittal will be marked revise and resubmit. After doors are installed, hardware Vendor shall field verify if additional brackets and shims required before installing closers. Provide written language in submittals for how areas requiring special applications will be installed.

2.9 STOPS AND HOLDERS

A. Door Stops/Holders and Bumpers:

1. Acceptable Manufacturers:

- a. Ives Manufacturing.
- b. Triangle Brass Manufacturing Company, Inc. (Trimco).
- c. Rockwood.
- d. Hager Manufacturing.

2. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device:

- a. Stops, Bumpers and/or Holders shall meet the requirements of BHMA A156.16, Grade

1.

- b. Coordinate with specifications in Section 05 40 00 and Section 09 22 16 for required wall backing.

2.10 ACCESSORIES

A. Kick/Mop Plates:

1. Acceptable Manufacturers:

- a. Ives Manufacturing.
- b. Triangle Brass Manufacturing Company, Inc. (Trimco).
- c. Hager Manufacturing.

B. Where hardware groups/sets have different information, refer to the following for clarification. Provide hardware groups/sets devices along with added devices as indicated on Drawings and detailed requirements for each type of device.

- 1. Coordinate length and sizes for hardware devices before ordering materials (verify the door hardware is compatible for use with the doors and door/frames). Protection plate example: LDW nomenclature in Part 3 means "less door width". A 48 inch wide door would have a 46 inch wide protection plate. Width shall be one inch less than door width unless doors have protective edge guards or center mullions. Coordinate before submittals.

C. Lock Guards:

1. Acceptable Manufacturers:

- a. Triangle Brass Manufacturing Company, Inc. (Trimco).
- b. Ives Manufacturing.
- c. Hager Manufacturing.

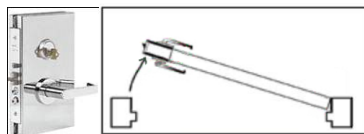
D. Door Silencers:

1. Acceptable Manufacturers:

- a. Ives Manufacturing.
- b. Triangle Brass Manufacturing Company, Inc. (Trimco).
- c. Rockwood.
- d. Hager Manufacturing.

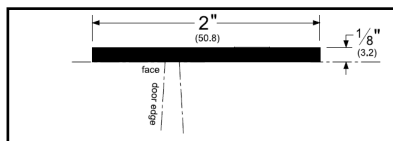
E. Gates and Gate Hardware Accessories:

- 1. Provide welded astragals, lock patches (templates), and/or welded mounting devices required for a complete installation of specified hardware, whether or not shown on Drawings and details. Weld in accordance with manufacturer's recommendations. Provide devices ground smooth and paint to match gate/fence system. See Section 09 91 00 for paint and primer requirements. Inserted pictures below are examples of lock patches and/or welded mounting devices. Template gates for each type of hardware device.



2. Gate Astragal:

- a. Provide fully welded astragal full height of gate to overlap either adjacent fence post or the adjacent gate at pair of gates.
 - 1) Provide full height astragal in width indicated on Drawings. If not indicated, provide astragal width no less than 2 inches wide. See inserted picture below.
 - 2) Provide full height astragal overlap width per details. If not indicated, provide overlap of astragal no less than 3/4 inch wide.
 - 3) Provide 1/8 inch astragal thickness. See inserted picture below.
 - 4) Where Pemko Manufacturing 357 Series astragal is utilized by gate manufacturer, do not use screws or order with screw holes. Nomenclature: ND prefix or suffix required by Pemko on 357 Series astragal.



- b. Provide devices ground smooth and painted to match gate/fence system. See Section 09 91 00 for paint and primer requirements.
3. Gate Canebolts (for maintenance gates only):
- a. Where nomenclature or device "524 Series" non-padlock canebolt-type devices are specified in hardware group/sets, provide by Crown Industrial, South San Francisco, CA; (650) 952-5150; <http://www.crown-industrial.com/>, or accepted equal.
 - b. Where nomenclature or device "stock #0524PL and/or part #0000478" series padlockable canebolt-type devices are specified in hardware group/sets, provide series by Crown Industrial, South San Francisco, CA; (650) 952-5150; <http://www.crown-industrial.com/>, or accepted equal.
 - c. On pairs of gates that have egress lever trim and or exit/panic device push-pad trim on active side gate, install canebolt away from the door edge so that both the canebolt and supplied the padlock cannot not impede the active gate from opening at any time, providing free egress.
 - d. Provide compatible galvanized steel pipe canebolt receptor and strike plate mounted in concrete slab as required.
 - 1) At padlockable canebolts, provide sufficient canebolt receptor depth to enable use of padlock.
 - 2) Provide canebolt receptors at both closed position of gate and open position of gate at 90 degrees, unless shown differently on Drawings.
 - e. Canebolts shall be mounted and welded in accordance with manufacturer's recommendations.
 - 1) Coordinate with other welding requirements in Contract Documents.
 - 2) Provide devices ground smooth and painted to match gate/fence system. See Section 09 91 00 for paint and primer requirements.
 - f. Products by the following manufacturers will be considered for acceptance providing all specified criteria have been met in full. Furnish all items and components of hardware required to complete the work in accordance with specifications, Contract Documents, and intended operation.
 - 1) Guardian Gate; www.guardiangatehardware.com.

- 2) Ameristar.
- 3) Monumental Iron Works.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames and verify mounting locations as indicated on shop drawings.
- B. Report unacceptable conditions to the Architect. Begin installation only when unacceptable conditions have been corrected.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions and accepted shop drawings.
- B. Door-Floor Clearances:
 1. Unless otherwise shown, provide the following door-floor clearances:
 - a. Maximum 5/8 inch.
- C. Hardware Placement:
 1. Place hardware at the following heights:
 - a. Hinges: Door and frame manufacturer's standard scope per additional specifications and plans.
 - b. Lever handles for latchsets, lockset and panic/exit device pull, lever trim:
 - 1) 38 inches above finish floor/surface.
 - 2) Verify manufacturer's template with door design.
 - c. Door Pulls and Push Bars (centerline): mounted / centered 42 inches above finished floor or ground.
 - d. Closers:
 - 1) To meet opening force requirements
 - 2) See installation below.
 2. Hardware for door handles, pulls, latches, locks, and other operating devices for use on means of egress doors shall comply with SFM Standard 12-10-2, Section 12-10-202 as contained in CCR Title 24, Part 12.
- D. Installation:
 1. Except for hinges, do not install hardware until painting and finishing work is completed.
 2. Pre-drill pilot holes in wood for screws. Drill and tap for surface mounted hardware on metal.
 3. Hinges: Set hinges snug and flat in mortises. Hand turn screws to flat seat – do not drive.
 4. Locksets: Install locks with keyways in proper position. Install levers, roses, and escutcheons firmly affixed.
 5. Closers:
 - a. To meet non-rated opening/exterior opening force requirements as well as close and latch non-smoke non-fire rated doors:

- 1) Closers are to be installed as close to the hinge side of door as possible by a trained installer per this Section, Part 1 "Quality Assurance, Installer Qualifications", installer an authorized representative of manufacturers, minimum of five years successful experience installing closers to meet 5-pound opening force for non-rated door complexity".
- 2) For non-smoke or non-fire rated doors, before installation of closers install one mockup door for each kind of closer application. Example: parallel, regular arm, stop arm and/or top-jamb arm application if specified. Confirm doors meet 5-pound opening force and still close door. This will ensure proper installation for doors to open at 5 pounds opening force before remaining non-rated opening closers are installed. The closer the closer is installed to the hinge, the better performance for 5-pound opening force, but still close and latch door.
 - b. Mount door closers for maximum swing but at non-rated doors to meet 5-pound opening force. At all possible openings, mount door closers for maximum swing of door before setting stops.
 - c. Mount door closers for maximum swing, but at non-rated doors to meet 5-pound opening force. Drawings may show doors open to only 90 degrees (Revit or CAD system set up), but unless noted or specified with limiter (stop arm devices below), all doors to open for maximum swing against adjacent 180 wall if nothing inhibits door from doing so. Include wide-throw hinges per specs and installation for 170 degree to 180 degree or maximum swing of door before installing stops.
6. Floor Stops: See notes on closers and hinges above. After auto operator or closer devices are installed, and door is opened as far as possible without #1) occupant excessive force on auto operator or closer; and #2) door does not hit adjacent wall or other surfaces, stops shall be installed at substantial completion a maximum of 4 inches from adjacent walls and as far away from the hinge point as possible (preference is to have stops installed just below lever or pull locations).
7. Silencers: Set in place before adjusting strikes.

3.3 PAINT OR FIELD FINISHES

- A. Coordinate with Contact Documents including, but not limited to, Section 09 91 00 for paint and primer requirements.

3.4 ADJUSTING

- A. Adjust parts for smooth, uniform operation.
- B. Lubricate moving parts with manufacturer recommended lubricant.
- C. Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.
- D. Adjust door closer devices:
 1. Adjust closer operating.
 - a. Interior and Exterior Doors: Not to exceed 5.0 pounds force.
 2. Adjust closer delay and operating speeds to comply with requirements of 2025 CBC Section 11B-404.2.8.1.
 - a. Doors/gates closers, when provided, shall have sweep period adjusted: minimum of 5 seconds for a door/gate to close from the 90 degree position to the 12 degree position.

3.5 CLEANING

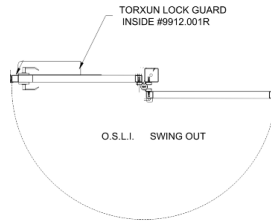
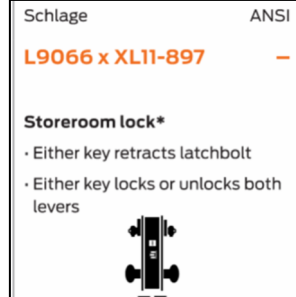
- A. Clean as recommended by manufacturer. Do not use materials or methods which may damage finish or surrounding construction.

3.6 HARDWARE SCHEDULE

Blank space below and after a Group/Set is intentional to avoid, if possible,
splitting a Hardware Group/Set onto two pages

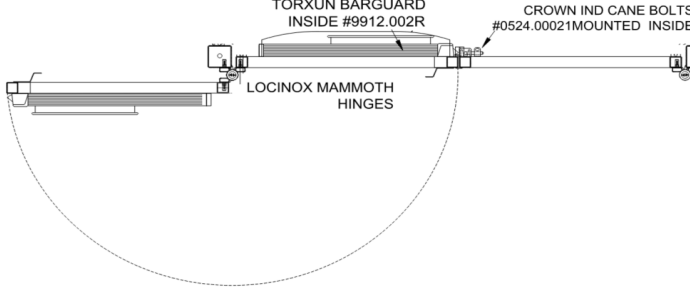
Hardware Sets (Typically Three-Digit Set Numbers)

Hardware Group/Set #101

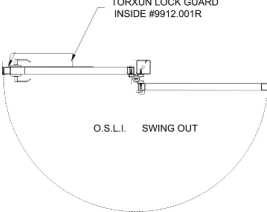
1	Ea.	Hydraulic Closers / Hinges Sets	Locinox manufacturing #Mammoth 180 Hydraulic Closers/Hinges Set: Heavy duty 180° hydraulic gate closer and hinge for gates up to 330 lbs. x Black Finish (note: if round post similar to chain-link, provide additional Locinox brackets part #CLB Mammoth). At gates weighing over 330 pounds, provide Ultra heavy duty 180° hydraulic gate closer and hinge for gates up to 440 lbs gate leafs. 		LO
1	Ea.	Double Keyed Classroom-Type Lockset  KeeDEX Inc • 510 Cameron Street • Placentia, CA 92678 Phone (714) 993-4300 • Fax (714) 993-4301 Email- gates@keedex.com • Web- www.keedex.com	L9066T x XL1-1897 x Longitude Lever x A rose (not an egress door) (provide Weldable Box as required for mortise device – see www.keedex.com) ground smooth finish, primed and painted to match remaining area. 	630	SC
1	Ea.	Lock Guard (inside)	TORXUN manufacturing – see www.torxun.com part #9912.001R (or equal devices as required by architectural details, and language in Section 08 71 00)		
2	Ea.	I/C Cylinders (Rim or Mortise)	20-757 or 20-763 x appropriate cam x blocking rings as required (rim or mortise type and quantity as required by locking device)	626	SC
2	Ea.	Permanent Core)	20-740	626	SC
1	Ea.	Floor Stop	FS18L (installed only after punch walk/substantial completion)	630	IV
1	Ea.	Bottom of doors to be greater than 10" Clear, Unobstructed & Smooth Surface	Per above specifications and by gate manufacturer (push-side, ground smooth, primed and painted to match gate).		
1	Ea.	Painted Full Height Astragal	Per above specifications and by gate manufacturer and per specifications (utilized as a positive stop – when gate closes against the astragals the opening cannot swing back in toward the egress side)		
1	Ea.	At gates G305, G306, and G307 only provide Knox Box	3200 Series (per specifications) and for locations as shown on Architectural Drawings		

Note: Furnish all devices & components for hardware groups/set above in accordance with Contract Documents (including but not limited to additional hardware devices requirements in the above specification language, architectural plans & full specification documents).

Hardware Group/Set #102

2	Ea.	Hydraulic Closers / Hinges Sets	Locinox manufacturing #Mammoth 180 Hydraulic Closers / Hinges Set: Heavy duty 180° hydraulic gate closer and hinge for gates up to 330 lbs. x Silver Finish. At gates weighing over 330 pounds, provide Ultra heavy duty 180° hydraulic gate closer and hinge for gates up to 440 lbs gate leafs. for weather 		LO
1	Ea.	Active Leaf: Institutional Storeroom-Type Lockset	L9082T x 06 Lever x A Rose (provide Weldable Box as required for mortise device – see www.keeDEX.com) ground smooth finish, primed and painted to match remaining area. 	630	SC
1	Ea.	Lock Guard (inside)	TORXUN manufacturing – see www.torxun.com part #9912.001R (or equal devices as required by architectural details, and language in Section 08 71 00)		
2	Ea.	I/C Cylinders (Rim or Mortise)	20-757 or 20-763 x appropriate cam x blocking rings as required (rim or mortise type and quantity as required by locking device)	626	SC
2	Ea.	Permanent Core	20-740	626	SC
2	Ea.	Stop	FS18L (installed only after substantial completion)	630	IV
2	Ea.	Bottom Rail (kickplate)	Gates to have greater than 10" clear, unobstructed and smooth surface per above specifications and by gate manufacturer (push-side, ground smooth, primed and painted to match gate).		
1	Ea.	Painted Full Height Astragal	Per above specifications and by gate manufacturer and per specifications (utilized as a positive stop – when gate closes against the astragals the opening cannot swing back in toward the egress side)		
Note: Furnish all devices & components for hardware groups/set above in accordance with Contract Documents (including but not limited to additional hardware devices requirements in the above specification language, architectural plans & full specification documents).					

Hardware Group/Set #103

1	Ea.	Hydraulic Closers / Hinges Sets	Locinox manufacturing #Mammoth 180 Hydraulic Closers/Hinges Set: Heavy duty 180° hydraulic gate closer and hinge for gates up to 330 lbs. x Black Finish (note: if round post similar to chain-link, provide additional Locinox brackets part #CLB Mammoth). At gates weighing over 330 pounds, provide Ultra heavy duty 180° hydraulic gate closer and hinge for gates up to 440 lbs gate leafs. 		LO
1	Ea.	Institutional Storeroom-Type Lockset Keedex Inc • 510 Cameron Street • Placentia, CA 92678 Phone (714) 993-4300 • Fax (714) 993-4301 Email- gates@keedex.com • Web- www.keedex.com	L9082T x 06 Lever x A Rose (provide Weldable Box as required for mortise device – see www.keedex.com) ground smooth finish, primed and painted to match remaining area. 	630	SC
1	Ea.	Lock Guard (inside)	TORXUN manufacturing – see www.torxun.com part #9912.001R (or equal devices as required by architectural details, and language in Section 08 71 00)		
2	Ea.	I/C Cylinders (Rim or Mortise)	20-757 or 20-763 x appropriate cam x blocking rings as required (rim or mortise type and quantity as required by locking device)	626	SC
2	Ea.	Permanent Core)	20-740	626	SC
1	Ea.	Floor Stop	FS18L (installed only after punch walk/substantial completion)	630	IV
1	Ea.	Bottom of doors to be greater than 10" Clear, Unobstructed & Smooth Surface	Per above specifications and by gate manufacturer (push-side, ground smooth, primed and painted to match gate).		
1	Ea.	Painted Full Height Astragal	Per above specifications and by gate manufacturer and per specifications (utilized as a positive stop – when gate closes against the astragals the opening cannot swing back in toward the egress side)		
1	Ea.	Knox Box	3200 Series (per specifications) and for locations as shown on Architectural Drawings		
Note: Furnish all devices & components for hardware groups/set above in accordance with Contract Documents (including but not limited to additional hardware devices requirements in the above specification language, architectural plans & full specification documents).					

Hardware Group/Set #104

—	Ea.	Hinges	Hinges by chain-link gate manufacturer		
2	Ea.	Inactive Leaf: Lockable Canebolt-Type Devices	0524PL and/or part #0000478 x 24"x black zinc x Stainless Steel Ground Receiver/Strike		
2	Ea.	Padlock	KS43F320 (2" inch shackle)		SC
2	Ea.	Padlock Permanent Core	20-740	626	SC
2	Ea.	Stop	FS18L (installed only after substantial completion)	630	IV
2	Ea.	10" Bottom Rail	Bottom of gates to be greater than 10" clear, unobstructed & smooth surface (per above specifications and by gate manufacturer push-side, ground smooth, primed and painted to match gate)		
1	Ea.	Knox Box	3200 Series (per specifications) and for locations as shown on Architectural Drawings		

Note: Furnish all devices and components for hardware groups/set above in accordance with Contract Documents including, but not limited to, additional hardware devices required in Section 08 71 00 language, architectural plans, and full specification documents.

Hardware Group/Set #105

Note: Openings assigned this set on the door schedule are to be doors, frames and hardware by gate manufacturer (no 08 71 00 scope on these openings).

Hardware Group/Set #106

—	Ea.	Hinges	Hinges by chain-link gate manufacturer		
2	Ea.	Inactive Leaf: Lockable Canebolt-Type Devices	0524PL and/or part #0000478 x 24"x black zinc x Stainless Steel Ground Receiver/Strike		
2	Ea.	Padlock	KS43F320 (2" inch shackle)		SC
2	Ea.	Padlock Permanent Core	20-740	626	SC
2	Ea.	Stop	FS18L (installed only after substantial completion)	630	IV
2	Ea.	10" Bottom Rail	Bottom of gates to be greater than 10" clear, unobstructed & smooth surface (per above specifications and by gate manufacturer push-side, ground smooth, primed and painted to match gate)		

Note: Furnish all devices and components for hardware groups/set above in accordance with Contract Documents including, but not limited to, additional hardware devices required in Section 08 71 00 language, architectural plans, and full specification documents.

Hardware Group/Set #107

	Ea.	Hinge	5BB1 x NRP (size and quantity per Section 08 71 00)	630	IV
1	Ea.	Auto Flush Bolt (top latch only where possible)	At non-rated 20 minute rated wood doors or at all hollow metal doors provide either #3810 (metal doors) or #3815L (wood doors) as required per door material For wood doors over 20 minutes in rating, provide top & bottom Flushbolts #3815L x #3815L and dust proof strike device #3911 For metal doors over 20 minutes in rating, provide fire bolt #3850 (no bottom bolt or dust proof strike).	626 / 630	TR
1	Ea.	Storeroom Lockset	ND80T x RHO x 10-025	626	SC
1	Ea.	Permanent Core	20-740	626	SC
1	Ea.	Coordinator	#3094 series x filler plates x mounting brackets as required for coordinated hardware	626	TR
2	Ea.	Surface Closer x Stop Arm	4040XP x SCUSH	689	LC
2	Ea.	Kick Plate	KO050 10" tall x 2" LDW (less door width) x B4E (beveled edges) x counter sunk or approved adhesive per 08 71 00.Part 2 (no raised fasteners)	630	TR
1	Ea.	Seals	5050B seals (head and jambs) by NGP		
Note: Furnish all devices and components for hardware groups/set above in accordance with Contract Documents (including but not limited to additional hardware devices requirements in the above specification language, architectural plans and full specification documents).					

Hardware Group/Set #108

	Ea.	Hinge	5BB1 x NRP (size and quantity per Section 08 71 00)	630	IV
1	Ea.	Storeroom Lockset	ND80T x RHO x 10-025	626	SC
1	Ea.	Permanent Core	20-740	626	SC
1	Ea.	Surface Closer x Stop Arm	4040XP x SCUSH	689	LC
1	Ea.	Kick Plate	KO050 10" tall x 2" LDW (less door width) x B4E (beveled edges) x counter sunk or approved adhesive per 08 71 00.Part 2 (no raised fasteners)	630	TR
1	Ea.	Seals	5050B seals (head and jambs) by NGP		
Note: Furnish all devices and components for hardware groups/set above in accordance with Contract Documents (including but not limited to additional hardware devices requirements in the above specification language, architectural plans and full specification documents).					

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- A. Section 05 50 00 – Metal Fabrications.

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. ASTM D523 – Standard Test Method for Specular Gloss.

1.4 SUBMITTALS

- A. Submit product data under provisions of Division 01.
- B. Provide product data on all painting products and accessories.
- C. Submit 4 brush-out samples 8 inches by 10 inches in size illustrating color and gloss level selected for each surface finishing product scheduled.
- D. During the Contract Closeout period, provide 2 copies of coating maintenance manual including, but not limited to, location of manufacturer's paint store closest to the project site, area summary with finish schedule, area detail designating where each product, color, and finish was used, product data sheets and material safety data sheets for each product used, color formulations for each color used, written cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with sufficient documented experience.
- B. Applicator: Company specializing in commercial painting and finishing with sufficient documented experience.

- C. Gloss Levels: Per Master Painters Institute (MPI) gloss standards MPI Gloss and Sheen Levels, measured in accordance with ASTM D523.

GLOSS LEVEL	DESCRIPTION	GLOSS AT 60 DEGREES ASTM D523	SHEEN AT 85 DEGREES ASTM D523
G1	A traditional matte finish – flat.	5 units, maximum	and 10 units, maximum
G2	A high side sheen flat - a velvet-like finish.	10 units, maximum	and 10 - 35 units
G3	A traditional eggshell-like finish.	10 - 25 units	and 10 - 35 units
G4	A satin-like finish.	20 - 35 units	and 35 units, minimum
G5	A traditional semi-gloss.	35 - 70 units	-
G6	A traditional gloss.	70 - 85 units	-
G7	A high gloss.	More than 85 units	-

1.6 REGULATORY REQUIREMENTS

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in manufacturer's original unopened, labeled containers; inspect to verify acceptance.
- B. Store and protect products from abuse and contamination.
- C. Container labeling is to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and written instructions for mixing and reducing.
- D. Store paint materials at minimum ambient temperature of 50 degrees F and a maximum of 90 degrees F, in well-ventilated area, unless required otherwise by manufacturer's written installation instructions.
- E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's written installation instructions.
- B. Minimum Application Temperatures for Paints: 50 degrees F, unless required otherwise by manufacturer's written installation instructions.
- C. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

1.9 EXTRA MATERIALS

- A. Provide a new and unopened one-gallon container of each type, color, and sheen to Owner.
- B. Label each container with color, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.1 PAINT SYSTEMS, GENERAL

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

2.2 SUSTAINABLE DESIGN REQUIREMENTS

- A. VOC Content of Field-Applied Paints and Coatings: Provide products that comply with the SCAQMD rule 1113 limits for VOC content.

2.3 ACCEPTABLE MANUFACTURERS – PAINT

- A. Refer to Table at the end of this Section.
- B. Substitutions: Under provisions of Division 01.

2.4 ACCEPTABLE MANUFACTURERS – PRIMER SEALERS

- A. Refer to Table at the end of this Section.
- B. Substitutions: Under provisions of Division 01.

2.5 MATERIALS

- A. All paint materials shall be provided from a single manufacturer unless noted otherwise in this Section.
- B. Coatings:
 - 1. Ready mixed. Process pigments to a soft paste consistency capable of being readily and uniformly dispersed to a homogeneous coating.
 - 2. Good flow and brushing properties; capable of drying or curing free of streaks or sags.
- C. All field-applied interior paints shall use zero VOC colorants.
- D. Accessory Materials: All other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.6 FINISHES

- A. Refer to schedule at end of Section for surface finish schedule. Colors as selected by Architect.

PART 3 EXECUTION

3.1 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. Beginning of application constitutes acceptance of existing surfaces.

3.2 PREPARATION

- A. Correct minor defects and clean surfaces that affect work of this Section.
- B. Seal marks that may bleed through surface finishes.
- C. Galvanized Surfaces: Remove passivators, oil, grease, acid residue, and surface contamination; wash with solvent. Apply coat of etching primer, unless otherwise recommended by finish coating system manufacturer.

3.3 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.

3.4 APPLICATION

- A. Apply products in accordance with manufacturer's written installation instructions.
 - 1. Paint mil thicknesses shall not be less than the minimums recommended by the paint manufacturers.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- E. Sand lightly between coats to achieve required finish.
- F. Allow applied coat to dry before next coat is applied.

3.5 CLEANING

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

3.6 PAINTING SCHEDULE – EXTERIOR SURFACES:

A. Galvanized Metal Handrail and Guardrail Assemblies:

1. 1st coat – Etch Prep.
2. 2nd coat – Epoxy Flat Primer.
3. 3rd and 4th coats – High Dispersion Pure Acrylic Polymer Semi-Gloss.

APPLICATION	TYPE	MPI Gloss Level	MANUFACTURERS			
			Dunn- Edwards/ Carboline	Pittsburgh Paint Co./ PPG	Sherwin-Williams	Benjamin Moore
PRIMERS						
Exterior Galvanized Metal Handrail and Guardrail Assemblies	Epoxy	G1	Carboline Rustbond PS	PPG Amerlock 2 VOC	B58 646-100	Corotech V155
FINISHES						
Exterior Galvanized Metal Handrail and Guardrail Assemblies	High Dispersion Pure Acrylic	G5	ASHL50	95-8001	B53W03151	Corotech V500
MISCELLANEOUS						
Exterior Heavy-Duty Cleaner	Water-Based	N/A	Krud Kutter Gloss-Off	PPG DuraPrep 88	---	Corotech V600
Exterior Galvanized Metal Etch Prep.	N/A	N/A	Krud Kutter Metal Clean and Etch, Dissco Eco-Prime 100, or Jasco Prep & Prime			

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Exterior signage:
 - 1. Accessibility signage.
 - 2. Metal dimensional characters.
- B. Interior signage:
 - 1. Accessibility signage.
 - 2. Occupancy load signage.
- C. Life safety signage.

1.2 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A283/A283M – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 4. ASTM B26/B26M – Standard Specification for Aluminum-Alloy Sand Castings.
 - 5. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 6. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 7. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - 8. AWS D1.1 – Structural Welding Code – Steel.
 - 9. AWS D1.2 – Structural Welding Code – Aluminum.
 - 10. NFPA 101 – Life Safety Code.
 - 11. UL 924 – Emergency Lighting and Power Equipment.

1.3 SUBMITTALS

- A. General: Submit in accordance with Division 01.
- B. Shop Drawings: Submit shop drawing for each sign and plaque to show construction, sections, text, character spacing, fonts, colors, and mounting details.
- C. Product Data: Submit product data for each product specified in this Section with the product and selected attributes clearly identified.
- D. Samples: Submit one full-size physical sample of each of the following sign types:
 - 1. Functional room sign demonstrating font, color, symbols, and braille characters.
 - 2. Restroom sign demonstrating font, color, symbols, and braille characters.
 - 3. Dimensional metal character demonstrating material, font, size, and finish.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm specializing in manufacturing products specified in this Section with a minimum five years' experience.
- B. Regulatory Requirements:
 - 1. Accessibility Signage, General: Provide signage in accordance with California Code of Regulations, Title 24, Part 2, Chapter 11B, Sections 11B-216 and 11B-703, 2025 California Building Code.
 - a. Finish, Color, and Contrast: Characters, pictograms, symbols, and their backgrounds shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.
 - b. Depth: Raised characters shall be 1/32 inch minimum above their background.
 - c. Case:
 - 1) Raised Characters: Characters shall be uppercase.
 - 2) Visual Characters: Characters shall be uppercase or lowercase or a combination of both.
 - d. Style: Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative, or of other unusual forms. Raised characters shall be sans serif.
 - e. Proportions:
 - 1) Raised characters on signs shall be selected from fonts where the width of the uppercase letter O is 60 percent minimum and 110 percent maximum of the height of the uppercase letter I. Stroke thickness of the uppercase letter I shall be 15 percent maximum of the height of the character.
 - 2) Visual characters on signs shall be selected from fonts where the width of the uppercase letter O is 60 percent minimum and 110 percent maximum of the height of the uppercase letter I.

- f. Character Height:
 - 1) Raised Characters: Character height measured vertically from the baseline of the character shall be 5/8 inch minimum and 2 inch maximum based on the height of the uppercase letter I. Stroke thickness of tactile characters shall be 15 percent maximum of the height of the character.
 - 2) Visual Characters: Minimum character height shall comply with CBC Table 11B-703.5.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the uppercase letter I.
- g. Character Spacing:
 - 1) Raised Characters: Character spacing shall be measured between the 2 closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be 1/8 inch minimum and 4 times the raised character stroke width maximum, Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8 inch minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch minimum. Spacing between individual tactile characters shall comply with CBC Section 11B-703.2.7 and Section 11B-703.2.8.
 - 2) Visual Characters: Character spacing shall be measured between the 2 closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of character height.
- h. Line Spacing: Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height.
- i. Format: Text shall be in horizontal format.
- j. Braille: Comply with CBC Section 11B-703.3, contracted Grade 2 Braille.
 - 1) Dimensions and Capitalization: Braille dots shall have a domed or rounded shape and shall comply with CBC Table 11B-703.3.1. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.
 - 2) Position: Braille shall be positioned below the corresponding text in a horizontal format, centered under text. If text is multi-lined, Braille shall be placed below the entire text. Braille shall be separated 3/8 inch minimum and 1/2 inch maximum from any other tactile characters and 3/8 inch minimum from raised borders and decorative elements.
- k. Pictograms: Comply with CBC Section 11B-703.6.
 - 1) Pictogram Field: Pictograms shall have a field height of 6 inches minimum. Characters and Braille shall not be located in the pictogram field.
 - 2) Text Descriptors: Pictograms shall have text descriptors located directly below the pictogram field. Text descriptors shall comply with CBC Sections 11B-703.2, 11B-703.3, and 11B-703.4.

- I. Symbols of Accessibility: Symbols of accessibility shall comply with CBC Section 11B-703.7.
 - m. Edges and verticals on geometric symbols shall comply with CBC Section 11B-703.7.2.6.4.
2. Accessibility Signage:
 - a. Tactile Exit Signage: CBC Chapter 10 “Means of Egress,” Section 1013 “Exit Signs,” Section 1013.1 “Where Required,” and Section 1013.4 “Raised Character and Braille Exit Signs”.
 - 1) Tactile signs required by CBC Section 1013.4 need not be provided with illumination per Section 1013.3.
 - 2) Tactile Stairway Signs (DSA-AC and SFM Requirements): CBC Section 1023.9 “Stairway Identification Signs”.
 - b. Other Accessible Signage: CBC Chapter 11B, “Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.”
 - 1) Toilet Room and Bathing Room Signage: CBC Section 11B-216.8, “Toilet Rooms and Bathing Rooms” and CBC Section 11B-703.7.2.6, “Toilet and Bathing Facilities Geometric Symbols”.
 - 2) Assistive Listening Symbol: CBC Section 11B-216.10, “Assistive Listening Systems” and Section 11B-703.7.2.4, “Assistive Listening Systems”. Assistive Listening System signs shall be provided at all assembly areas, including conference rooms and meeting rooms, as defined in CBC Chapter 2 and Chapter 11B.
 - 3) Detailed Requirements for Accessible Signage: CBC Chapter 11B, Division 7, Section 11B-703, “Signs”.
 - a) Sign Mounting Heights and Locations: CBC Sections 11B-703.4, 11B-703.5.6, and 11B-703.7.2.6.
 - b) Symbols of Accessibility: CBC Section 11B-703.7, “Symbols of Accessibility”.
 - c) International Symbol of Accessibility: CBC Section 11B-703.7.2.1, “International Symbol of Accessibility”.
 - d) Entrance Signs: CBC Section 11B-216.6, “Entrances”.
 - 4) Accessible Parking Signage: CBC Section 11B-502.6 “Identification”.
 - 5) Post or Pylon Mounted Signs: CBC Section 11B-307.3 “Post-Mounted Objects”.
 - c. Field Inspection: Signs and identification shall be field inspected after installation and approved by the enforcing agency, in accordance with CBC Section 11B-703.1.1, “Plan Review and Inspection”.
3. Exit Signage: Provide signage in accordance with California Code of Regulations, Title 24, Part 2, 2025 California Building Code, Chapter 10 “Means of Egress”, Section 1013 “Exit Signs”, as applicable to Occupancy Group.
 - a. Illuminated Exit Signs: CBC Section 1013.1 “Where Required”, Section 1013.3 “Illumination”, Section 1013.5 “Internally Illuminated Exit Signs”, and Section 1013.6 “Externally Illuminated Exit Signs”.
 - b. Floor Exit Signs (SFM Requirement): CBC Section 1013.7 “Floor-Level Exit Signs”.
4. Wind Load Requirements: Exterior signage shall be designed to resist wind loads in accordance with CBC.

C. Pre-Installation Meetings:

1. Conduct pre-installation meeting in accordance with provisions of Division 01.
2. Convene pre-installation meeting 1 week prior to commencing work of this Section.
3. Coordinate work in this Section with work in related Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Division 01.
- B. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- C. Storage and Protection: Store materials in a dry secure place. Protect from weather, surface contaminants, corrosion, construction traffic, and other potential damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. WeidnerCA, Sacramento, CA; 800-561-7446, <https://weidnerca.com>.
2. ASI Sign Systems, Inc., Irving, TX; 800-274-7732, www.asisignage.com.
3. In Pro Corporation, Muskego, WI; 800-222-5556, www.inprocorp.com.
4. Mohawk Sign Systems, Schenectady, NY; 800-223-7705, www.mohawksign.com.
5. APCO Graphics, Inc., Atlanta, GA; 877-988-2726, www.apcosigns.com.
6. Diverse ID, Riverside, MO; 800-818-4540, www.diverseid.com.

B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Acrylic Plastic: Non-glare finish acrylic with integral color as manufactured by Romark (www.hansensupply.com), CYRO Industries Acrylite FF (www.acrylite.co) or accepted equal. Thickness shall be 1/4 inch at door mounted geometric symbols and 1/8 inch minimum at all other locations, unless noted otherwise. Colors as selected by Architect from manufacturer's full range of colors.
- B. Aluminum: ASTM B209 for sheet or plate; ASTM B221 for extrusions, and ASTM B26/B26M for castings. Aluminum extrusions shall be 1/8 inch thick minimum. Wall and post mounted panels shall be 0.080 inch thick minimum. Aluminum panels shall have a non-glare acrylic polyurethane paint finish.
- C. Steel Posts: ASTM A53/A53M, Type E or S, Grade B; galvanized 1-1/2 inch nominal pipe size (NPS), Schedule 40. Provide 1/8 inch thick steel cap (ASTM A283/A283M) welded to top of post. Galvanize post and cap to minimum G50 in accordance with ASTM A123/A123M.
- D. Silk Screen Ink: Nazdar 9700 Series All Purpose Screen Ink as manufactured by Nazdar Ink Technologies (www.nazdar.com) or accepted equal. Colors as selected by Architect.
- E. Anchors and Fasteners: Stainless steel conforming to ASTM F593.

2.3 EXTERIOR SIGNAGE

A. Accessible Signage: Provide the following signage in accordance with 2025 CBC where indicated on the Drawings.

1. Accessible Parking Stall Sign: Provide a 12 inch wide by 18 inch high metal panel, reflectorized International Symbol of Accessibility sign, mounted on a single post, at every accessible parking stall indicated on the Drawings. Text shall occur below the symbol and read PARKING ONLY.
2. Van Accessible Parking Stall Sign: Provide a 12 inch wide by 18 inch high metal panel, reflectorized International Symbol of Accessibility sign, mounted on a single post for each van accessible parking stall as indicated on the Drawings. Text shall occur below the symbol and read PARKING ONLY. Mounted on the same post, below this sign, a sign of the same width and required height shall display the text VAN ACCESSIBLE. Refer to Drawings for additional sign information.
3. Electric Vehicle Charging Accessible Parking Stall Sign: Provide a 12 inch wide by 18 inch high metal panel, reflectorized International Symbol of Accessibility sign, mounted on a single post, at every accessible parking stall with electric vehicle charging indicated on the Drawings. Text shall occur below the symbol and read EV CHARGING.
4. Electric Vehicle Charging Van Accessible Parking Stall Sign: Provide a 12 inch wide by 18 inch high metal panel, reflectorized International Symbol of Accessibility sign, mounted on a single post for each van accessible parking stall with electric vehicle charging as indicated on the Drawings. Text shall occur below the symbol and read EV CHARGING. Mounted on the same post, below this sign, a sign of the same width and required height shall display the text VAN ACCESSIBLE. Refer to Drawings for additional sign information.
5. Sign for Parking Violation Fine: An additional sign or additional language below the symbol of accessibility shall state Minimum Fine \$250.
6. Restroom Signage:
 - a. Boys' Restroom Symbol (door mounted): Provide for each boys' restroom door an equilateral triangle, 1/4 inch thick with 12 inch long sides, vertex pointing upward. The color of the triangle symbol shall contrast with the door color, either light on a dark background or dark on a light background.
 - b. Boys' Restroom Sign (wall mounted): Provide for each boys' restroom a 6 inch wide by 10 inch high acrylic plaque with an international symbol of accessibility centered at the top of the sign; 5/8 inch high by 1/32 inch raised, inlaid characters below to read BOYS; corresponding contracted Grade 2 Braille 3/8 inch minimum to 1/2 inch maximum below text.
 - c. Girls' Restroom Symbol (door mounted): Provide for each girls' restroom door a circle, 1/4 inch thick and 12 inch in diameter. The color of the circle symbol shall contrast with the door color, either light on a dark background or dark on a light background.
 - d. Girls' Restroom Sign (wall mounted): Provide for each girls' restroom a 6 inch wide by 10 inch high acrylic plaque with an international symbol of accessibility centered at the top of the sign; 5/8 inch high by 1/32 inch raised, inlaid characters below to read GIRLS; corresponding contracted Grade 2 Braille 3/8 inch minimum to 1/2 inch maximum below text.

- e. Unisex Restroom Symbol (door mounted): Provide for each unisex restroom door a circle, 1/4 inch thick and 12 inch in diameter with a 1/4 inch thick equilateral triangle with a vertex pointing upward superimposed on the circle and within the 12 inch diameter. The triangle symbol shall contrast with the circle, either light on a dark background or dark on a light background. The circle symbol shall contrast with the door color, either light on a dark background or dark on a light background.
 - f. Unisex Restroom Sign (wall mounted): Provide for each unisex restroom a 6 inch wide by 10 inch high acrylic plaque, with an international symbol of accessibility centered at the top of the sign; 1 inch high by 1/32 inch raised text below to read STAFF; with corresponding contracted Grade 2 Braille 3/8 inch minimum to 1/2 inch maximum below text.
7. Functional Room Signage: Provide acrylic plastic room signage with inlaid characters raised 1/32 inch, upper case, sans serif type with corresponding contracted Grade 2 Braille. Raised characters shall be at least 5/8 inch high, but no higher than 2 inches. Color selections from manufacturer's full range of colors. Characters and symbols shall contrast with their background per CBC Section 11B-703.

B. Exterior Metal Dimensional Characters:

1. Manufacturers:
 - a. Vomar Products, Inc., Canoga Park, CA; 818-610-5115, <https://vomarproducts.com>.
 - b. Gemini Sign Letters, Marlborough, MA; 508-485-3343, <https://geminisignletters.com>.
 - c. Or accepted equal.
2. Material: ASTM B209 laser cut or water jet cut aluminum plate or ASTM B26/B26M #514 alloy cast aluminum.
3. Size: As indicated on Drawings.
4. Font: Helvetica Medium, all capital letters, 1-1/2 inch thick, 5/8 inch thick strokes.
5. Characters Required: Refer to Drawings.
6. Finish: Class I anodized finish or factory paint finish. Finish type and color as selected by Architect.

2.4 INTERIOR SIGNAGE

- A. Accessible Signage: Provide the following signage in accordance with 2025 CBC where indicated on Drawings:
1. Material: Acrylic plastic, edges rounded, chamfered, or eased. Corners shall have minimum radius of 1/8 inch.
 2. Color: Characters, symbols, and pictograms on contrasting background per CBC Section 11B-703. Colors as selected by Architect from manufacturer's full range of colors.
 3. Functional Room Signage: Provide room signage with inlaid characters raised 1/32-inch, upper case, sans serif type with corresponding contracted Grade 2 Braille. Raised characters shall be at least 5/8 inch high, but no higher than 2 inches. Characters and symbols shall contrast with their background per CBC Section 11B-703.
 4. Assistive Listening Signage: Provide sign notifying availability of assistive listening system, 13 inch wide by 8 inch high acrylic plaque with international symbol of access for hearing loss in compliance with CBC Figure 11B-703.7.2.4 imprinted centered at the top of the sign and characters below with text ASSISTIVE LISTENING SYSTEM AVAILABLE FROM SCHOOL ADMINISTRATOR.

5. Tactile Exit Signage:

- a. Provide tactile exit signs at doors in rooms or areas that require more than one exit or exit access per CBC Sections 1013.1 and 1013.4.
 - b. Acrylic plaque tactile exit signs shall have text at least 5/8 inch high, but no higher than 2 inch high, and corresponding contracted Grade 2 Braille shall be placed a minimum of 3/8 inch and a maximum of 1/2 inch directly below the text as follows:
 - 1) Each grade-level exterior exit door that is required to comply with CBC Section 1013.1 shall be identified by a tactile exit sign with the word EXIT.
 - 2) Each exit door that is required to comply with CBC Section 1013.1, and that leads directly to a grade-level exterior exit by means of a stairway or ramp shall be identified by a tactile exit sign with the following words as appropriate: EXIT STAIR DOWN, EXIT RAMP DOWN, EXIT STAIR UP, or EXIT RAMP UP. At exit discharge level, door sign shall include a raised 5-pointed star located to the left of the identifying floor level.
 - 3) Each exit door that is required to comply with CBC Section 1013.1, and that leads directly to a grade-level exterior exit by means of an exit enclosure or an exit passageway shall be identified by a tactile exit sign with the words EXIT ROUTE.
 - 4) Each exit access door from an interior room or area to a corridor or hallway that is required to comply with CBC Section 1013.1 shall be identified by a tactile exit sign with the words EXIT ROUTE.
 - 5) Each exit door through a horizontal exit that is required to comply with CBC Section 1013.1 shall be identified by a tactile exit sign with the words TO EXIT.
- B. Occupancy Load Signs: Provide occupancy load sign. Text for sign MAXIMUM OCCUPANCY LOAD ____ BY ORDER OF THE STATE FIRE MARSHAL.
1. Blank Space Text: Coordinate text requirement for blank spaces with Architect prior to sign fabrication and installation.

2.5 LIFE SAFETY SIGNAGE

- A. Exit Signs: Internally illuminated exit signs conforming to NFPA 101, Section 7.10.7; UL listed in accordance with UL 924, with wording in legible characters not less than 4 inch high and text EXIT.

2.6 FABRICATION

- A. Work shall be assembled in the shop, as far as practical, ready for installation at the site. Work that cannot be shop assembled be trial fit in the shop to ensure proper field assembly.
- B. Drill or punch holes for bolts and screws; produce clean, true lines, and surfaces.
- C. Acrylic signs shall have inlaid acrylic copy/characters and Braille symbols as described in this Section.
- D. Aluminum welding shall be in accordance with AWS D1.2. Steel welding shall be in accordance with AWS D1.1. Welding shall be continuous along the entire area of contact. Grind smooth exposed welds.
- E. Galvanized items shall be hot-dip process after fabrication if practical in accordance with ASTM A123/A123M.

- F. Exposed work surfaces shall have a smooth finish, and exposed riveting shall be flush. Fastenings shall be concealed where practical.
- G. Joints exposed to the weather shall be formed to exclude water. Provide drainage and weep holes to prevent condensation buildup.

2.7 SHOP FINISHING

- A. Surfaces of miscellaneous metal work, except nonferrous metal, corrosion resisting steel, and zinc-coated work, shall be given 1 coat of zinc-molybdate primer or an accepted rust-resisting treatment and metallic primer in accordance with manufacturer's standard practice.
- B. Surfaces to be embedded in concrete shall not be painted.
- C. Upon completion of work, damaged surfaces shall be recoated.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install signs and plaques level and plumb.
- B. Mount sign posts directly into concrete foundation. Mount sign to post using stainless steel tamper resistant mechanical fasteners as recommended by manufacturer and accepted by the Architect.
- C. Accessible Sign Mounting Heights and Locations:
 - 1. Site Signage:
 - a. Parking Signage: Per CBC Section 11B-502.6, signs not located within a circulation path shall be 60 inches minimum above the finish floor or ground surface measured to the bottom of the sign.
 - 2. Mounting Height with Tactile Characters: Per CBC Section 11B-703.4.1, tactile characters on signs shall be located 48 inches minimum above the finished floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches maximum above the finished floor or ground surface, measured from the baseline of the highest line of raised characters.
 - 3. Mounting Location with Tactile Characters: Per CBC Section 11B-703.4.2 as follows:
 - a. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side.
 - b. Where a tactile sign is provided at double doors with 1 active leaf, the sign shall be located on the inactive leaf.
 - c. Where a tactile sign is provided at double doors with 2 active leafs, the sign shall be located to the right of the right hand door.
 - d. Where there is no space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall.
 - e. Signs containing tactile characters shall be located so that a clear floor space of 18 inch minimum by 18 inch minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.

- f. Where permanent identification signage is provided for rooms and spaces, they shall be located on the approach side of the door as one enters the room or space. Signs that identify exits shall be located on the approach side of the door as one exits the room or space.
- 4. Mounting Height with Visual Characters: Per CBC Section 11B-703.5.6, visual characters shall be 40 inches minimum above the finished floor or ground.
- 5. Toilet and Bathing Facility Signage: Per CBC Section 11B-703.7.2.6, the geometric door symbol shall be mounted at 58 inches minimum and 60 inches maximum above the finished floor or ground surface measured from the centerline of the symbol. The symbol shall be mounted within 1 inch of the vertical centerline of the door.
- D. Metal Dimensional Characters: Mount to substrate with metal studs threaded into sign and silicone adhesive into metal wall receivers.
- E. Exterior Restrooms Signs and Functional Room Signs: Mount to exterior door and wall surfaces using tamper proof stainless steel mechanical fasteners suitable for the mounting substrate as recommended by the manufacturer and accepted by the Architect.
- F. Interior Functional Room Signs, Tactile Exit Signs, Assistive Listening Signs, and Occupancy Load Signs: Mount to door and wall surfaces with double faced adhesive foam tape strips applied vertically along the sides with silicone construction adhesive applied in between.

3.2 ADJUST AND CLEAN

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

3.3 CLEAN-UP

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

END OF SECTION

SECTION 10 90 00
MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings:
 - 1. Indicate fabrication, materials, installation details, finishes, connections to utilities and any other required anchoring, fastenings, and hardware.
 - 2. Submit drawing layout for product configuration, support attachment, and anchorage details.
- C. Product Data: Submit product data for each product specified in this Section with the product and selected attributes clearly identified.

1.3 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 MOP SINK

- A. Manufacturer:
 - 1. Basis of Design: Florestone Products Co., Inc., Madera, CA; 559-661-4171, florestone.com. Product: MSR-2424.
 - 2. Or accepted equal.
 - 3. Substitutions: Under provisions of Division 01.
- B. Features:
 - 1. Molded one-piece mop sink, molded under heat and pressure using matched metal dies.
 - 2. The sink shall be one piece with no seams.
 - 3. Shoulders shall be no less than 1 inch wide and 9-1/2 inch inside.
 - 4. Receptor shall have ribbed underbody and integral drain providing for a no-caulked connection to a 2 inch or 3 inch ABS pipe.
 - 5. Drain grid shall be 18-gauge stainless steel, flat type, #430.

2.2 MOP SINK FAUCET

A. Manufacturer:

1. Basis of Design: Zurn Industries, LLC, Falconer, NY; 800-997-3876, www.zurn.com. Product: Z843M1-RC.
2. Or accepted equal.
3. Substitutions: Under provisions of Division 01.

B. Features:

1. Rough chrome-plated cast brass 8 inch sink faucet with quarter turn ceramic disc cartridges.
2. 3/8 inch short swivel inlets providing adjustable centers from 7-1/4 inch to 8-3/4 inch.
3. Integral service stops and a 6 inch centerline cast brass spout with chemical resistant vacuum breaker.
4. 3/4 inch hose threaded outlet.
5. Pail hook and adjustable wall brace.
6. Unit shall be furnished with 2-1/2 inch vandal-resistant color-coded metal lever handles.

2.3 ELECTRIC WATER HEATER

A. Manufacturer:

1. Basis of Design: Rheem Water Heating, Roswell, GA; 800-432-8373, www.rheem.com. Product: PR0E10 1 RH POU.
2. Or accepted equal.
3. Substitutions: Under provisions of Division 01.

B. Features:

1. Capacity: 10 gallons.
2. 3/4 inch N.P.T. outlet, inlet, anode rod.
3. T & P valve connections.
4. Standard 120 volt AC, 2000 watt single high efficiency heating element
5. Height: 23 inches.
6. Diameter: 15-3/4 inches.

C. Warranty: 6 year limited tank and parts warranty.

2.4 PEDESTAL DRINKING FOUNTAIN

A. Manufacturer:

1. Basis of Design: Haws, Sparks, NV; 775-359-4712, www.hawesco.com. Product: 3612F outdoor bottle filler and drinking fountain.
2. Or accepted equal.
3. Substitutions: Under provisions of Division 01.

B. ADA and CBC Chapter 11B compliant pedestal bottle filler and drinking fountain shall include:

1. heavy duty stainless-steel pedestal with matte silver powder-coating.
2. One bottle filler and two drinking fountains, filter-ready with mounting bracket and configured waste assembly.
3. Push-button operated stainless steel valves with front-accessible cartridge and flow adjustment
4. Polished chrome-plated brass vandal-resistant shielded bubbler heads.
5. Large-opening bottle filler with quick-fill 1 gpm flow rate.
6. 100 percent lead-free waterways.
7. Polished chrome-plated vandal-resistant waste strainers with top-down clean-out access on fountains.
8. Vandal-resistant access plates, integral mounting feet, and 1-1/2 inch slip waste.

PART 3 EXECUTION

3.1 INSTALLATION

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

3.2 ADJUST AND CLEAN

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

END OF SECTION

SECTION 11 66 00
ATHLETIC EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Exterior basketball assemblies.

1.2 RELATED SECTIONS

- A. Section 11 60 23 – Modular Sport Courts.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Division 01.
- B. Shop drawings shall clearly show all pertinent dimensions, data, sizes, post-setting requirements, and fastening requirements for exterior basketball backstop and vertical post assemblies.
- C. Submit Maintenance Manuals under provisions of Division 01.

1.4 QUALITY ASSURANCE

- A. Installer's Qualifications: Installation shall be by manufacturer's authorized representative employing skilled mechanics thoroughly trained and experienced in this type of installation and who are completely familiar with the requirements of the work specified.
- B. All material and equipment shall be furnished by manufacturers regularly engaged in production of these items. Manufacturer's recommendations shall be followed in all cases for installation and conditions.
- C. Comply with all local, State, or Federal codes and regulations. Manufacturer and manufacturer's representative shall have a minimum of prior 5 successful jobs, similar in scope, with DSA approval.
- D. The installer and/or manufacturer shall maintain a regular service facility within a 150-mile radius of the area in which the equipment installation is located.
- E. Provide Manufacturer's standard one-year warranty. Backboards provided with center strut attachment shall have manufacturer's limited lifetime warranty. Ultra Flex Goals shall have manufacturer's limited two-year warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to project site in manufacturer's original, unopened, and undamaged packaging. Store in original packaging under protective cover and protect from damage. Handle materials in such a manner as to prevent damage to products or finishes.

1.6 WARRANTY

- A. Provide manufacturer's standard warranty with the following durations:
 - 1. Pole and rim: Lifetime warranty.
 - 2. Backboard: 10 years from date of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Bison, Inc., Lincoln, NE; 800-247-7668, bisoninc.com. Product: PR77XL Mega-Duty Steel Rectangle Extended Gooseneck Playground System.
- B. Porter Athletic, Champaign, IL; 888-277-7778, www.gillporter.com.
- C. Draper, Inc., Spiceland, IN; 800-238-7999, www.draperinc.com.
- D. Substitutions: Under provisions of Division 01.

2.2 EXTERIOR BASKETBALL ASSEMBLY COMPONENTS:

- A. Pole:
 - 1. Material: 5-9/16 inch outside diameter schedule 40 structural pipe with hot dipped galvanized finish.
 - 2. Design shall be a bent gooseneck style in size and configuration to allow for a 48 inch embedment into the ground and 96 inch extension from the front of the pole to the face of the backboard. Pole shall be designed such that the rim mounts directly to the horizontal pole section through the backboard to eliminate stress on the backboard during play.
- B. Braces: Two 1-5/8 inch diameter, 13 gauge flow coated galvanized tubular braces shall support the top of the backboard and connect directly to the pole.
- C. Backboard:
 - 1. Material: Formed and welded steel with a 42 inch x 60 inch rectangular playing surface. Skin shall be 12 gauge mild steel and rear structure shall be 7 gauge and 10 gauge steel. All edges of the skin shall be formed so that no shear edges are exposed. Backboard shall accept rims with 5 inch x 5 inch mounting patterns.
 - 2. Finish: The backboard shall be coated with a white polyester powder coated finish and have an official-sized orange shooter's square. Backboard shall carry a limited
- D. Rim:
 - 1. Construction: Two 5/8 inch diameter AISI 1018 cold drawn carbon steel rings welded together at a minimum of six places. Back and side plates shall be 3/16 inch thick steel and be continuously welded. The net attachment system shall be of a continuous type constructed of 3/16 inch x 1 inch steel with punched net attachment slots suitable for nylon nets. Rim shall be factory pre-drilled to mount on any front mount backboard.
 - 2. Finish: Factory applied orange powder coated finish.
- E. Accessories:
 - 1. Provide one twelve-loop nylon net per assembly.
 - 2. Manufacturer's standard mounting hardware for backboards and rims.
- F. Concrete: 3,000 pounds per square inch minimum compressive strength at 28 days, 3 inch to 4 inch slump; 1 inch nominal coarse aggregate.

PART 3 EXECUTION

3.1 CONDITION OF SURFACES

- A. Examine substrates where goal assemblies are to be installed. Do not proceed with the work of this Section until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Backstops shall be installed and fastened in place in accordance with manufacturer's written installation instructions and in accordance with CBC requirements.
- B. Locate pole footings to ensure proper alignment of backboards with associated sport courts.
- C. Set poles plumb in concrete footings with top of footing sloped 2 percent to finish grade for water runoff. Poles shall be set so that height of goal in installed assemblies is as indicated on Drawings.
- D. Brace poles as required to maintain plumb alignment until concrete has fully set.
- E. Final Adjustment: Check backstop installation for correct rigidity of installation.
- F. Defective Work: Remove and replace all defective work that cannot be properly repaired, cleaned or touched-up, as directed by the Architect, with no additional cost to the Owner.
- G. Protect the installed work against damage from other construction.

3.3 CLEAN UP

- A. Upon completion of the work of this Section, remove all surplus materials, rubbish, and debris from the premises.
- B. Cleaning and Finishing: Upon completion, clean all exposed surface, removing any discoloration or foreign matter. Touch-up abraded or cut areas and exposed edges with finishing material recommended by the manufacturer. Touch-up shall not be obvious.

END OF SECTION

SECTION 11 66 23
MODULAR SPORT COURTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Modular Sports Solution: Fully contained modular sports solution including fence panels and goals

1.2 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A153 -Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.3 SUBMITTALS

- A. Submit shop drawings under provisions of Division 01.
- B. Product Data: Submit product data for each product specified in this Section with the product and selected attributes clearly identified.
- C. Shop drawings shall include engineering design calculations and shall clearly show all pertinent dimensions, data, sizes and anchorage requirements.
- D. Manufacturer's written installation instructions.
- E. Submit maintenance information under provisions of Division 01.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products of this Section in accordance with manufacturer's written instructions.
- B. Delivery Timing Equipment On-Site: The equipment shall be on-site 12 to 16 weeks from receipt of approved submittals and receipt of complete order information.

1.5 QUALITY ASSURANCE

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system by a single manufacturer.

1.6 STRUCTURAL PARAMETERS

- A. Wind Loads: Wind loads shall be based on the 2025 California Building Code. Wind loads to be calculated using ASCE 7-22, a design wind speed of 95, exposure category C and wind importance factor of risk category II.

1.7 WARRANTY

- A. 10-Year Warranty: Manufacturer shall supply a signed warranty covering the entire system for 10 years from the date of shipment. Manufacturer shall maintain specifically funded financial reserve to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.
- B. Maintenance: Manufacturer is responsible for removal and replacement of failed components, including all parts, labor, shipping, and equipment rental associated with maintenance.

PART 2 PRODUCTS

2.1 MANUFACTURER AND PRODUCT

- A. Basis of Design: Musco Sports Lighting, LLC., Oskaloosa, IA; 800-825-6020, musco.com. Product: Mini-Pitch System.
- B. Or accepted equal.
- C. Substitutions: Under provisions of Section 01 60 00.

2.2 MODULAR SPORTS SOLUTION CONSTRUCTION

- A. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot-dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot-dip galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed.
- B. System Description: Modular sports solution shall consist of the following:
 - 1. Pitch Fence Panels and Goal Assembly Construction:
 - a. Mini-Pitch Size: 104 ft x 60 ft.
 - b. Assemblies: Fence panels, and goal assemblies shall be prefabricated for ease of assembly. Component assemblies shall bolt together to form the final construction. No single panel or component shall weigh more than 2000 pounds for ease of installation with forklift or telehandler.

- c. Fence Panels: Sideline fence panels shall have a finished height of 3 ft, minimum. End line fence panels shall have a finished height of 6 ft, minimum. Panels shall be constructed of 2 inch round or square tube steel and 0.120 inch thick steel plate.
 - d. Goals: Minimum size of 90 inches wide x 70 inches tall x 34 inches deep, constructed of 2 inch round or square tubing, 0.120 inch thick steel plate, and 0.19 inch chain link.
 - e. Gated Entryways:
 - 1) Gated entryways shall meet accessibility requirements of CBC Chapter 11B
 - 2) Gates shall be configured to provide minimum of 2 points of entry/egress (one on each side of the pitch).
 - 3) Gates shall be latchable.
 - f. Anchor Plates: Each fence panel and component shall have anchor plates for securing the system to the ground. Each anchor plate shall be equipped with leveling hardware for independent alignment of each component.
3. Storage:
- a. Lockable storage shall be integrated into the modular structure.

PART 3 EXECUTION

3.1 CONDITION OF SURFACES

- A. Examine all areas where products of this Section are to be installed. Coordinate work of this Section with work of other Sections to assure proper location of sport courts and preparation of substrates. Do not proceed with the work of this Section until unsatisfactory conditions have been corrected and substrates are acceptable for installation of the Work of this Section.

3.2 INSTALLATION

- A. Install all products specified in this Section per the manufacturer's written instructions.
- B. Final Adjustment: Verify that products of this Section have been installed per manufacturer's written instructions, and that units have been fastened securely to each other and anchored to substrates.
- C. Defective Work: Remove and replace all defective work that cannot be properly repaired, cleaned or touched-up, as directed by the Architect, with no additional cost to the Owner.
- D. Protect the installed work against damage from other construction.

3.3 CLEAN UP

- A. Upon completion of the work of this Section, remove all surplus materials, rubbish, and debris from the premises.
- B. Cleaning and Finishing: Upon completion, clean all exposed surface, removing any discoloration or foreign matter. Touch-up abraded or cut areas and exposed edges with finishing material recommended by the manufacturer. Touch-up shall not be obvious.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with CEC.

PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Aluminum Conductors: Comply with ASTM B800 and ASTM B801.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW and SO.
- E. Multiconductor Cable: Comply with NEMA WC 70 for Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.

- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway.
- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- J. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- K. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway.
- L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- M. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- N. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

- 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

- B. Perform tests and inspections and prepare test reports.

- C. Tests and Inspections:

- 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

- D. Test Reports: Prepare a written report to record the following:

- 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

- E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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: Grounding systems and equipment.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
 - 5. Grounding for sensitive electronic equipment.
- C. Qualification Data: For qualified testing agency and testing agency's field supervisor.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells based on NETA MTS and NFPA 70B.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 EXECUTION

3.1 APPLICATIONS

- A. All grounding shall be done in accordance with CEC Article 250.
- B. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by CEC Article 250:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Signal and Communication Equipment: In addition to grounding and bonding required by CEC, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
 - 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
 - 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect

- grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

3.4 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 25 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 5 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 25 ohm(s).
 - 5. Substations and Pad-Mounted Equipment: 5 ohms.
 - 6. Manhole Grounds: 25 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with CEC.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those re-

quired by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.
- D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.4 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

2.6 WARNING LABELS AND SIGNS

A. Comply with CEC and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.7 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 1/2 inch.

2.9 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 5. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to raceways concealed within wall.

3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot (3-m) maximum intervals.
- C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 1. Emergency Power.
 2. Power.
 3. UPS.
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- F. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

- H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for both direct-buried cables and cables in race way.
- I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by CEC and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.

- c. Access doors and panels for concealed electrical items.
- d. Switchboards.
- e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- f. Emergency system boxes and enclosures.
- g. Enclosed switches.
- h. Enclosed circuit breakers.
- i. Enclosed controllers.
- j. Variable-speed controllers.
- k. Push-button stations.
- l. Power transfer equipment.
- m. Contactors.
- n. Remote-controlled switches, dimmer modules, and control devices.
- o. Battery-inverter units.
- p. Battery racks.
- q. Power-generating units.
- r. Monitoring and control equipment.
- s. UPS equipment.

END OF SECTION

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

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. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.

1.3 SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Qualification Data: For testing agency.
- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
- C. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ACME Electric Corporation; Power Distribution Products Division.
 - 2. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
 - 3. Controlled Power Company.
 - 4. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 5. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.

6. General Electric Company.
7. Hammond Co.; Matra Electric, Inc.
8. Magnetek Power Electronics Group.
9. Micron Industries Corp.
10. Myers Power Products, Inc.
11. Siemens Energy & Automation, Inc.
12. Sola/Hevi-Duty.
13. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 1. Internal Coil Connections: Brazed or pressure type. Coil Material: Aluminum or Copper.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: Indoor - Ventilated, NEMA 250, Type 2, Outdoors – Ventilated, NEMA 3R, Stainless Steel.
 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
 1. Finish Color: Gray.
- F. Taps for Transformers Smaller Than 3 kVA: None.
- G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- I. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- J. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 2. Tested according to NEMA TP 2.
 3. DOE 2016 Efficiency.

- K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 2. Indicate value of K-factor on transformer nameplate.
- L. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.
 - 3. Shield Effectiveness:
 - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
 - b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
 - c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.
- M Wall Brackets: Manufacturer's standard brackets.
- N. Fungus Proofing: Permanent fungicidal treatment for coil and core.
- O. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.
- P. Low-Sound-Level Requirements: Maximum sound levels, when factory tested according to IEEE C57.12.91, as follows:
 - 1. 30 to 50 kVA: 45 dBA value.
 - 2. 51 to 150 kVA: 50 dBA value.
 - 3. 151 to 300 kVA: 55 dBA value.
 - 4. 301 to 500 kVA: 60 dBA value.

2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by CEC and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- C. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- E. Remove and replace units that do not pass tests or inspections and retest as specified above.

- F. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
 - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 24 13 SWITCHBOARDS

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. Service and distribution switchboards rated 600 V and less.
 - 2. Transient voltage suppression devices.
 - 3. Disconnecting and overcurrent protective devices.
 - 4. Instrumentation.
 - 5. Control power.
 - 6. Accessory components and features.
 - 7. Identification.
 - 8. Mimic bus.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

- A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types for types other than NE MA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
 - 5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.

6. Detail utility company's metering provisions with indication of approval by utility company.
 7. Include evidence of NRTL listing for series rating of installed devices.
 8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
 10. Include diagram and details of proposed mimic bus.
 11. Include schematic and wiring diagrams for power, signal, and control wiring.
- C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.
- D. Qualification Data: For qualified testing agency.
- E. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Field Quality-Control Reports:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- G. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Routine maintenance requirements for switchboards and all installed components.
 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

- B. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Comply with NEMA PB 2.
- G. Comply with NFPA 70.
- H. Comply with UL 891.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Remove loose packing and flammable materials from inside switchboards.
- C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.7 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
 - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).
- C. Service Conditions: NEMA PB 2, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet (2000 m).
- D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by District or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager and District no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect's, Construction Manager's and Districts written permission.
4. Comply with NFPA 70E.

1.8 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Front-Connected, Front-Accessible Switchboards:
 1. Main Devices: Fixed, individually mounted.
 2. Branch Devices: Panel mounted.

3. Sections front and rear aligned.
- C. Nominal System Voltage: 480Y/277 V.
- D. Main-Bus Continuous: as indicated on drawings A.
- E. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- F. Indoor Enclosures: Steel, NEMA 250, Type 1.
- G. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- H. Outdoor Enclosures: Type 3R.
 1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
 2. Enclosure: Flat roof; bolt-on rear covers for each section, with provisions for padlocking.
- I. Barriers: Between adjacent switchboard sections.
- J. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.
- K. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.
- L. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- M. Removable, Hinged Rear Doors and Compartment Covers: Secured by standard bolts, for access to rear interior of switchboard.
- N. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- O. Buses and Connections: Three phase, four wire unless otherwise indicated.
 1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, with copper/aluminum feeder circuit-breaker line connections.
 2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
 3. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
- P. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- Q. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.
- R. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:
 1. Fuses, rated at 200-kA interrupting capacity.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect switch.
 4. Redundant suppression circuits.
 5. Redundant replaceable modules.
 6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 7. LED indicator lights for power and protection status.
 8. Audible alarm, with silencing switch, to indicate when protection has failed.
 9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 10. Four-digit, transient-event counter set to totalize transient surges.
- C. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.

- D. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277-V, three-phase, four-wire circuits shall be as follows:
 - 1. Line to Neutral: 800 V for 480Y/277.
 - 2. Line to Ground: 800 V for 480Y/277.
 - 3. Neutral to Ground: 800 V for 480Y/277.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I₂t response.
 - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

- h. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
- i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 IDENTIFICATION

- A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to switchboards.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

H. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front and rear panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:

- 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.7 DEMONSTRATION

A. Train District's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

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. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with CEC.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).

b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet (2000 m).

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Flush- and surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R, Stainless Steel.
 - c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Same finish as panels and trim.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 - 7. Directory Card: Inside panelboard door, mounted in transparent card holder.
- C. Incoming Mains Location: Top and bottom.
- D. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 - 5. Split Bus: Vertical buses divided into individual vertical sections.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 6. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: As indicated on drawings.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I₂t response.
 - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.

2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to panelboards.
 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.
- G. Install filler plates in unused spaces.
- H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- J. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- F. Panelboards will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

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. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge suppression units.
 - 4. Wall-box motion sensors.
 - 5. Isolated-ground receptacles.
 - 6. Snap switches and wall-box dimmers.
 - 7. Wall-switch and exterior occupancy sensors.
 - 8. Communications outlets.
 - 9. Pendant cord-connector devices.
 - 10. Cord and plug sets.
 - 11. Floor service outlets, and multioutlet assemblies.
- B. Related Sections include the following:
 - 1. Division 27 Section "Voice and Data Network System" for workstation outlets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with CEC.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Hubbell; CR 5253IG.
 - b. Leviton; 5362-IG.
 - c. Pass & Seymour; IG6300.
 - 2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; TR8300.
 - b. Hubbell; HBL8300SG.
 - c. Leviton; 8300-SGG.
 - d. Pass & Seymour; 63H.
 - 2. Description: Labeled to comply with CEC, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade,. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell; IG2310.

b. Leviton; 2310-IG.

2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 1995L.
 - b. Hubbell; HBL1557L.
 - c. Leviton; 1257L.
 - d. Pass & Seymour; 1251L.

2.8 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 OCCUPANCY SENSORS

A. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Hubbell; ATD1600WRP.
 - b. Leviton; ODW12-MRW.
 - c. Watt Stopper (The); DT-200.
2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

B. Exterior Occupancy Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Leviton; PS200-10.
 - b. Watt Stopper (The); EW-100-120.
2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.10 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 3560-6.
 - b. Leviton; 40649.
2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 3562.
 - b. Leviton; 40595.
2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6; and one Type F coaxial cable connector.

2.11 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant while-in-use, die-cast aluminum with lockable cover.

2.12 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular solid brass with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Blank cover with bushed cable opening, two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable.

2.13 MULTIOUTLET ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems.
 - 2. Wiremold Company (The).
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Wire: No. 12 AWG.

2.14 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by CEC or device listing.
 - 2. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of CEC, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 3 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

- B. Test straight blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

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. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.
4. Luminaire lowering devices.

B. Related Sections:

1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Luminaire: Complete lighting fixture, including ballast housing if provided.
- E. Pole: Luminaire support structure, including tower used for large area illumination.
- F. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
- C. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
 1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 90 mph (40 m/s).
 - a. Wind Importance Factor: 1.0.
 - b. Minimum Design Life: 25 years.
 - c. Velocity Conversion Factors: 1.0.

1.5 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 6. Photoelectric relays.
 - 7. Ballasts, including energy-efficiency data.
 - 8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
 - 9. Materials, dimensions, and finishes of poles.
 - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 - 11. Anchor bolts for poles.
 - 12. Manufactured pole foundations.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - 3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
 - 4. Wiring Diagrams: For power, signal, and control wiring.
- C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.
- D. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

G. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package steel poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
 - 1. LER Tests LED Fixtures: Where LER is specified, test according to NEMA LE 5A.
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of manufacturer's standard color.
 - c. Color: As selected by Architect from manufacturer's full range.
- N. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: Dark bronze.
- O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp and ballast characteristics:
 - a. "USES ONLY" and include specific lamp type.
 - b. CCT and CRI for all luminaires.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 2. Adjustable window slide for adjusting on-off set points.

2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
1. Materials: Shall not cause galvanic action at contact points.
 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.5 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
1. Shape: Round, tapered.
 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Brackets for Luminaires: Detachable, cantilever, without underbrace.
1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 3. Match pole material and finish.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

- D. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.
- E. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.
- F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- H. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.
- I. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- J. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
- K. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
 - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As indicated by manufacturer's designations.
- L. Metal Base Cover: Color to match pole and luminaire.

2.6 DECORATIVE POLES

- A. Pole Material:
 - 1. Cast ductile iron.
 - 2. Cast gray iron, according to ASTM A 48/A 48M, Class 30.
 - 3. Cast aluminum.
 - 4. Cast concrete.
 - 5. Spun concrete.
 - 6. Steel tube, covered with closed-cell polyurethane foam, with a polyethylene exterior.
- B. Mounting Provisions:
 - 1. Bolted to concrete foundation.

2. Embedded.

C. Fixture Brackets:

1. Cast ductile iron.
2. Cast gray iron.
3. Cast aluminum.

D. Pole Finish: Dark bronze to match luminaire.

2.7 POLE ACCESSORIES

A. Base Covers: Manufacturers' metal base cover units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

B. Decorative accessories, supplied by decorative pole manufacturer, include the following:

1. Round metal base covers: Finish to match pole and luminaire.

PART 3 EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

B. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.

4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
- F. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 1. Install grounding electrode for each pole unless otherwise indicated.
 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 1. Install grounding electrode for each pole.
 2. Install grounding conductor and conductor protector.
 3. Ground metallic components of pole accessories and foundations.

3.7 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
 - a. IESNA LM-64, "Photometric Measurements of Parking Areas."
 - b. IESNA LM-72, "Directional Positioning of Photometric Data."
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 27 32 43
ALS FM HEARING ASSISTANCE SYSTEM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Equipment for amplifying, transmitting and receiving sound signals for the hard of hearing, using FM signal technology.

1.2 SUBMITTALS

- A. General: Submit in accordance with Section 01330.
- B. Product Data: For each specific piece of equipment.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, and location of each field connection.
- D. Closeout Submittals: Submit following in accordance with Section 01780.
 - 1. Operation and Maintenance Data: For equipment.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced installer who is authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- C. Comply with NFPA 70.
- D. Comply with UL 50.

1.4 WARRANTY

- A. Warrant products in system to be free of defects in operation for 1 year, including parts and labor. Warranty for cords, antennas, power supply, and accessories is 90 days.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Williams Sound, Eden Prairie, MN.

2.2 ACCEPTABLE PRODUCTS

- A. Transmitters:
 - 1. PPA T27
- B. Receivers:
 - 1. PPA R37

C. Accessories:

1. Earphones
 - a. EAR 013
2. Neckloops
 - a. NKL 001
3. Batteries
 - a. BAT 001-2
4. Carry Cases
 - a. CCS 029
5. Antennas
 - a. ANT 021
6. Chargers
 - a. CHG 3512

2.3 COMPONENT PERFORMANCE CRITERIA

A. Stationary Transmitter (PPA T27):

1. Dimensions: 4.1" W x 6.1" L x 1.3" H (104.1 mm x 154.9 mm x 33 mm)
2. Weight: 7.8 oz. (221 g)
3. Color: Black
4. Power (U.S./Canada): 105-130 VAC, 50-60 Hz, 3.2 W at 120 VAC
5. Operating Frequencies: 72-76 MHz*: 72.1 (CH A), 72.2 (CH K), 72.3 (CH B), 72.4 (CH N), 72.5 (CH C), 72.6 (CH O), 72.7 (CH D), 72.8 (CH P), 72.9 (CH E), 74.7 (CH I), 75.3 (CH J), 75.4 (CH R), 75.5 (CH F), 75.6 (CH S), 75.7 (CH G), 75.8 (CH T), 75.9 (CH H)
6. Frequency Selector: External switches, 17 channels (lockable)
7. RF Field Strength: Does not exceed 80mV/m @ 3m
8. Nominal Range: Up to 1000 feet (305 m) w/standard ANT 021 "rubber duckie" antenna or optional ANT 005 coaxial antenna.
9. Modulation: FM, 75 kHz deviation (wide-band) max.
10. Stability: $\pm .005\%$ over 0-50°C
11. Pre-Emphasis: 75 μ S
12. Frequency Response: 85Hz - 14kHz ± 3 dB
13. Distortion: 1% Max. THD
14. Signal to Noise Ratio: 18 dB min. and 65 dB max. (R35 Receiver) (11B-706.5)
15. Microphone Input: 3.5mm mini phone jack, supplies +DC for electret mics
16. Mic Input Level: 1-10 mV, nominal
17. Line-Level Input: RCA Jack, Hi Z, unbal.
18. Line Input Level: 0.1-1.0 Vrms, nominal
19. Input Attenuator: Pot, screwdriver-adjustable

- 20 Antenna Outputs: Thread mount for ANT 021 “rubber duckie” antenna or ANT 025 telescoping antenna RF connector for ANT 024 dipole or ANT 005 coaxial antenna
- 21 Approvals: FCC, IC, RoHS, WEEE
- 22 Warranty: Lifetime PLUS Limited Warranty

B. Receiver (PPA R37):

- 1. Dimensions: 4.1” x 2.85” x 1.38” (104 x 72 x 35mm)
- 2. Weight: 4.6oz (130g) with batteries; 2.6oz (73g) without batteries
- 3. Color: Black
- 4. Battery Type: (2) AA Alkaline or 2 x AA NiMH
- 5. Battery Life: Two (2) AA non-rechargeable alkaline batteries (BAT 001), approx. 50 hrs; or (2) AA rechargeable NiMH batteries (BAT 026), 1500 mAh, approx. 32 hrs
- 6. Current Consumption: 52mA nominal
- 7. Temperature Range: – 0 to 50C
- 8. Channels: 17, accessed via seek button in battery compartment
- 9. Operating Freq.: 72.1, 72.2, 72.3, 72.4, 72.5, 72.6, 72.7, 72.8, 72.9, 74.7, 75.3, 75.4, 75.5, 75.6, 75.7, 75.8, 75.9 MHz*
- 10. Intermediate Freq.: 75 kHz
- 11. FM Deviation: 75 kHz
- 12. De-Emphasis: 75 μ S
- 13. LED Indicator: Power: Green; Low Battery: Flashes Green
- 14. AFC Range: $\pm$ 120 kHz
- 15. Sensitivity: 2 μ V at 12 dB Sinad with squelch defeated
- 16. Input Overload: 100 mV
- 17. Frequency Response: 200 – 15 kHz
- 18. Modulation: FM, +/- 75 kHz peak deviation
- 19. Signal-to-Noise Ratio: 65 dB min @ 100 μ V
- 20. Receive Antenna: Integral with earphone/headphone cord
- 21. Audio Output: 35 mW peak into 16 Ω - Peak Clipping level under 18 dB (11B-706.6)
Sound pressure level: 110 dB min. and 118 dB max with dynamic range volume range of 50 dB (11B-706.4)
- 22. Output Connector: 3.5 mm stereo/mono jack
- 23. Earphone: Earbud-type with foam cushion, 3.5 mm plug, 32 Ω
- 24. Auto Shut-off Enters sleep mode after approx 6 mins of no RF signal
- 25. Approvals: FCC, IC, RoHS, WEEE
- 26. Warranty: Lifetime PLUS Limited Warranty

C. Accessories:

- 1. Earphones
 - a. Single Mini Earbud: Model EAR 013

2. Neckloop
 - a. 18in cord, 3.5mm plug): Model NKL 001
3. Batteries
 - a. AA Alkaline: Model BAT 001-2
4. Carry Cases
 - a. Small Briefcase for accessories: CCS 029
5. Antennas
 - a. Remote Coaxial Antenna for 72-76 MHz PPA Transmitters: Model ANT 021
6. Chargers
 - a. 12 Units, R37: Model CHG 3512

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment to comply with manufacturer's recommendations.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with typical service loops, no excess. Use lacing bars in cabinets.

3.2 GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.3 FIELD QUALITY CONTROL

- A. Operational Test: Perform tests that confirm proper operation of system and proper coverage in area where equipment will be used.

3.4 DEMONSTRATION

- A. Demonstration and Instruction of Owner's Personnel: Provide in accordance with Section 01800. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment as specified.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, building pads, walks, paths, or trails and any other site improvements called for on the Plans.

1.2 SECTION EXCLUDES

- A. Earthwork related to underground utility installation shall be performed in accordance with Sections 31 21 00, Utility Trenching and Backfill.

1.3 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 01 50 50, Erosion Control
- C. Section 31 10 00, Site Clearing
- D. Section 31 23 19, Dewatering
- E. Section 33 46 00, Subdrainage

1.4 RELATED DOCUMENTS

- A. Geotechnical Report: Geotechnical Engineering and Geohazards Report Update, with Preliminary Percolation Testing Proposed ELOP Center Project, Phase 1A, prepared by Earth Systems Pacific, dated January 19, 2026
- B. ASTM
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D1586, Method for Penetration Tests and Split-Barrel Sampling of Soils
 - 3. D2487, Classification of Soils for Engineering Purposes
 - 4. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 5. D4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 6. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 7. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- C. California Building Code, California Code of Regulations, Title 24, Part 2, Chapter 18, Soils and Foundations, and Chapter 33, Safeguards During Construction
- D. Caltrans Standard Specifications, 2015
 - 1. Section 17, General

2. Section 19, Earthwork

E. CAL/OSHA, Title 8.

1.5 DEFINITIONS

- A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.
- B. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by the Geotechnical Engineer.
 - 2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.
- C. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- D. Structural Backfill: Soil materials approved by the Geotechnical Engineer and used to fill excavations resulting from removal of existing below grade facilities, including trees.
- E. Structural Fill: Soil materials approved by the Geotechnical Engineer and used to raise existing grades.
- F. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.
- I. 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 weeds, roots, and other deleterious materials.
- J. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. The Geotechnical Engineer will determine if a soil material is unsuitable.
- K. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.
- L. Utilities: onsite underground pipes, conduits, ducts and cables.

1.6 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.

B. Samples:

1. If required by the Geotechnical Engineer, provide 20 pound samples, sealed in airtight containers, tagged with source locations and suppliers of each proposed soil material from on-site or borrow sources, 72 hours prior to use. Do not import materials to the Project without written approval of the Geotechnical Engineer.
2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer.

C. Material Test Reports: Provide, from a qualified testing agency, the following test results showing compliance with the project requirements:

D. Classification according to ASTM D2487 of each onsite or borrow soil material proposed for fill and backfill.

1. Laboratory compaction curve in conformance with ASTM D1557 for each onsite or borrow soil material proposed for fill and backfill.

1.7 QUALITY ASSURANCE

A. Provide an independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.

B. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.

C. Conform all work in accordance with Caltrans Standard Specification Section 17, General and Section 19, Earthwork.

D. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.

E. Perform excavation, filling, compaction and related earthwork under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the District. Notify the Geotechnical Engineer at least 24 hours prior to commencement of earthwork and at least 48 hours prior to testing.

F. The Geotechnical Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.

G. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications and the Geotechnical Report. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of the Geotechnical Engineer have been displaced or are otherwise unsatisfactory due to the Contractor's operations.

H. Finish subgrade tolerance at completion of grading:

1. Building and paved areas: ± 0.05 feet

2. Other areas: ± 0.10 feet

1.8 PROJECT CONDITIONS

- A. Promptly notify the District's Representative of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the District's Representative verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless the Contractor has notified the District's Representative in writing of differing conditions prior to the Contractor starting work on affected items.
- B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Prevent erosion of freshly-graded areas during construction and until such time as permanent drainage and erosion control measures have been installed in accordance with Section 01 50 50, Erosion Control.
- D. Temporarily stock-pile fill material in an orderly and safe manner and in a location approved by the District's Representative.
- E. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. General: On-site soils are considered suitable for use as fill provided the materials are placed in accordance with Geotechnical Recommendations. Highly expansive soils shall not be used as select structural fill, or used as backfill for trenches located within hardscape areas.
- B. Imported fill soils, if required, should be predominantly granular in nature, and should be free of organics, debris, or rocks over 3 inches in size, and shall be approved by the Geotechnical Engineer before importing to the site. Imported non-expansive soils shall have a Plasticity Index less than 15 as determined by ASTM D4318, an R-value of at least 20, and fines content between 15 and 65 percent. Import fill shall be considered non-hazardous per Department of Toxic Substances Control guidelines (DTSC, 2017) and non-corrosive per Caltrans Corrosion Guidelines (Caltrans, 2015).

2.2 SOIL STERILANT

- A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wettable powder form.

PART 3 EXECUTION

3.1 GENERAL

- A. Perform work in accordance with Caltrans Standard Specification Section 19, Earthwork, as modified by the Contract Documents.
- B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- C. The use of explosives will not be permitted.
- D. Grading and earthwork operations shall be observed and tested by a representative of the Geotechnical Engineer for conformance with the project plans/specifications and the geotechnical recommendations. This work includes site preparation, selection of satisfactory materials, and placement and compaction of the subgrades and fills. Sufficient notification prior to commencement of earthwork is essential to make certain that the work will be properly observed.

3.2 CONTROL OF WATER AND DEWATERING

- A. Comply with Section 31 23 19, Dewatering, if dewatering is necessary.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.
- C. Dewater during backfilling operation so that groundwater is maintained a least 1 foot below level of compaction effort.
- D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.
- E. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- F. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.
- G. Maintain dewatering system in place until dewatering is no longer required.

3.3 WET WEATHER CONDITIONS

- A. Do not prepare subgrade, place or compact soil materials if subgrade or materials are above optimum moisture content.
- B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.4 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the District's Representative, submit details and calculations to the District's Representative. The District's Representative may forward the submittal to the Geotechnical Engineer, the

Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the District's Representative.

- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.5 TOPSOIL STRIPPING

- A. Remove topsoil in accordance with Section 31 10 00, Site Clearing.

3.6 EXCAVATION

- A. Excavate earth and rock to lines and grades shown on plans and to the neat dimensions indicated on the plans, required herein or as required to satisfactorily compact backfill.
- B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- C. Excavation through buried concrete and other unknown obstructions will require specialized techniques for demolition and removal.
- D. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- E. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.7 GRADING

- A. Uniformly grade the Project to the elevations shown on plans
- B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.
- C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.8 SUBGRADE PREPARATION

- A. Subgrade Preparation: Prior to backfilling depressions created by the removal of old foundations and utility lines, scarify the bottom of the excavation to an approximate depth of 8 inches and uniformly moisture condition the scarified surfaces to a moisture content that is at least 2 percent over optimum. Compact the scarified surfaces to a minimum of 90 percent relative compaction at above optimum moisture content.
- B. Over-excavate any remaining soft (pumping) areas down to firm soil and backfill the area.
- C. Subgrade shall be maintained in a moist, but not wet, condition by periodically sprinkling water prior to the placement of additional fill or installation of roads. Subgrade that has been permitted to dry out and loosen or develop desiccation cracking should be scarified, moisture conditioned, and re-compacted as recommended above.

- D. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.
- E. Prepare subgrades under the structural section of paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.
- F. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.
- G. Obtain the Geotechnical Engineer's approval of subgrades prior to placing pavement structural section.

3.9 KEYWAYS AND BENCHES

- A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway 5 feet minimum into competent, undisturbed soil or 3 feet minimum into competent, undisturbed rock as directed by the Geotechnical Engineer.
- B. Place subsurface drains in bottom of keyway in accordance with Section 33 46 00, Subdrainage.
- C. Bench subgrade as indicated above toe of fill.
- D. Place subsurface drains at benches every 20 vertical feet or as directed by the Geotechnical Engineer.

3.10 LOT FINISH GRADING

- A. Blade finish lots to lines and grades indicated.

3.11 FILL PLACEMENT AND COMPACTION

- A. Place fill in uniformly moisture conditioned and compacted lifts not exceeding 8 inches in loose thickness. Each lift should be thoroughly moisture conditioned and compacted to 90 percent before successive fill layers are placed.
- B. In order to achieve satisfactory compaction in the subgrade and fill soils, it may be necessary to adjust the soil moisture content at the time of soil compaction per geotechnical recommendations. This may require that water be added and thoroughly mixed into any soils which are too dry or that scarification and aeration be performed in any soils which are too wet.
- C. Obtain the Geotechnical Engineer's approval of surface to receive structural fill prior to placement of structural fill material.
- D. Place structural fill on prepared subgrade.
- E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.
- F. Do not compact by ponding, flooding or jetting.
- G. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by the Geotechnical Engineer.

H. Compaction requirements (unless specified otherwise by the Geotechnical Engineer):

1. Compact structural fills less than 5 feet thick to 90 percent compaction.
2. Compact structural fill 5 feet thick or greater to 95 percent compaction.
3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5 feet beyond pavement edges unless specified otherwise by the Geotechnical Engineer.
4. Compact the upper 6 inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.

3.12 SOIL STERILIZATION

- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.
- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

3.13 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the District.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Support and protection.
- B. Control of water and dewatering.
- C. Excavation.

1.2 SECTION EXCLUDES

- A. For earthwork related to underground utility installation, see Section 31 23 33 - Trenching and Backfilling.

1.3 RELATED REQUIREMENTS

- A. Section 01 57 13 - Temporary Erosion and Sediment Control
- B. Section 01 57 23 - Storm Water Pollution Control
- C. Section 31 10 00 - Site Clearing.
- D. Section 31 22 00 - Grading.
- E. Section 31 23 33 - Trenching and Backfilling.
- F. Section 31 23 19 - Dewatering.
- G. Section 31 23 23 - Fill.

1.4 REFERENCE STANDARDS

- A. Project Geotechnical Report: Geotechnical Engineering and Geohazards Report Update, with Preliminary Percolation Testing Proposed ELOP Center Project, Phase 1A, prepared by Earth Systems Pacific, dated January 19, 2026
- B. Cal/OSHA - California Occupational Safety and Health Administration Title 8 Regulations; Current Edition.
- C. California Building Code (CBC) - California Code of Regulations (CCR), Title 24, Part 2 - California Building Code; Current Edition.
- D. Caltrans Standard Specifications - Caltrans Standard Specifications; Current Edition.

1.5 SUBMITTALS

- A. Submittal Notation: Submittal documents to include specification number and title, and description of item of work covered.
- B. Excavation Support Details and Calculations:

1. If requested by the Owner's Representative, submit excavation support design details and calculations prepared and stamped by a registered civil or structural engineer licensed in State where the Project is located. Submittals may be reviewed by the Geotechnical Engineer, Consulting Engineer, and/or the Authorities Having Jurisdiction.
2. Include the basic design, assumed soil conditions, estimated forces, noted safety factors, dewatering related requirements, and plans and specifications of materials and methods.
3. Include the minimum lateral clearance from the edge of excavation support systems for vehicle access, construction equipment operation, and material stockpiling.
4. Do not proceed with excavations until the Owner's Representative responds to the submittal.

1.6 QUALITY ASSURANCE

A. Conform all work in accordance with:

1. Project Geotechnical Report.
2. Caltrans Standard Specifications, Section 17, General and Section 19, Earthwork.
3. California Building Code (CBC) Chapter 18, Soils and Foundations, and Chapter 33, Safeguards During Construction.

B. Perform earthwork under the observation and testing of the Geotechnical Engineer, or an independent testing firm if applicable, for conformance with the Project Drawings, Specifications, and Geotechnical Recommendations.

1. Earthwork must meet the approval of the Geotechnical Engineer or independent testing agency.
2. Notify the Geotechnical Engineer or independent testing firm before starting earthwork. Confirm the required advance notification time with the respective party.
3. Correct earthwork that, in the opinion of the Geotechnical Engineer or independent testing firm, does not meet the requirements of these Technical Specifications and the Geotechnical Report.

1.7 FIELD CONDITIONS

A. Ambient Conditions: Do not perform excavation during periods of heavy rain as directed by the Geotechnical Engineer, Owner's Representative, or Permitting Agency.

1. If unfavorable weather interrupts earthwork operations, take measures to prevent over-saturation of the working surface.
2. Provide adequate temporary drainage to prevent erosion.
3. Cover the subgrade or compact and grade the area to avoid water collection.
4. After interruption, re-establish compaction in the last layer before resuming work.

B. Existing Conditions: See geotechnical report, existing conditions survey, and site drawing.

C. Utility Location: Notify Underground Service Alert - [Call Before You Dig \(811\)](tel:811) to request approximate underground utility marking. Utility marking shall be performed prior to beginning excavation.

- D. Stormwater: Prevent erosion and stormwater pollution in accordance with Section 01 57 13 - Temporary Erosion and Sediment Control and Section 01 57 23 - Storm Water Pollution Control.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify survey benchmark elevations are as indicated on drawings.
- B. Survey existing adjacent structures and exterior improvements to establish exact elevations at fixed points for benchmarking.
- C. Assess adjacent structures and exterior improvements to establish existing conditions. Notify Owner's Representative in writing of existing cracks, sags, or other damages, as well as discrepancies in site conditions, prior to starting work.
- D. Verify prevailing groundwater level is as indicated.

3.2 PREPARATION

- A. See Section 31 10 00 for site clearing and topsoil removal.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect survey benchmarks, control points, and monuments from excavating equipment and vehicular traffic.
- D. Protect existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Protect trees, plants, lawns, rock outcroppings, and other features to remain.
 - 1. No grading is permitted under the drip line of protected trees, unless approved otherwise by the Arborist.
- F. Locate and identify known utilities to remain and protect from damage.

3.3 SUPPORT AND PROTECTION

- A. Excavation Safety: Comply with Cal/OSHA.
- B. Designate a Cal/OSHA competent person responsible for planning and inspecting excavations to ensure compliance with Cal/OSHA regulations, including soil type determinations.
- C. Protect open excavations with barriers, covers, or other methods to maintain safe pedestrian and vehicular traffic passage. Safely direct vehicular and pedestrian traffic through or around work area at all times.
- D. Place and maintain bracing and shoring as required to support the sides of the excavations for the protection of workers, to facilitate the work, to prevent damage to the facility being constructed, and to prevent damage to adjacent structures or facilities.

- E. Be responsible for all bracing and shoring, including the preparation of excavation support details and calculations as required.
- F. Install and extract sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.4 CONTROL OF WATER AND DEWATERING

- A. Comply with Section 31 23 19, Dewatering, if dewatering is necessary.
- B. Prevent surface water and groundwater from entering excavations and surrounding areas.
- C. Be responsible for dewatering excavations to the satisfaction of the Geotechnical Engineer and the Owner's Representative until fill is completed.
- D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.
- E. Dispose of water without causing surface erosion, sediment buildup, or endangering public health or property.
- F. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- G. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- H. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.5 EXCAVATION

- A. Grade top perimeter of excavation to prevent surface water collection.
- B. General Excavation:
 - 1. Excavate to indicated contours, elevations, and grades, or as required to satisfactorily compact backfill.
- C. Excavation for Exterior Improvements:
 - 1. Excavate to subgrade; do not disturb subsoils.
- D. Excavation to accommodate foundations and underground tanks.
 - 1. Excavate to subgrade.
- E. See Section 31 23 33 for utility trenching.
- F. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- G. Notify the Owner's Representative immediately, both verbally and in writing, of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
 - 1. No claims for differing conditions will be allowed unless written notice is given before starting work on affected items.

- H. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- I. Do not interfere with the load-bearing angle of foundations. See the Project Geotechnical Report for the soil bearing angle.
- J. See Section 31 22 00 for rough and fine grading.

3.6 FIELD QUALITY CONTROL

- A. Resurvey existing adjacent structure and exterior improvement benchmarks. Notify Owner's Representative of changes in elevations, positions, or slopes.
- B. Notify Owner's Representative of additional cracks, sags, or other damages to adjacent structures or exterior improvements occurring during work.

3.7 CLEANING

- A. Stockpile excavated material for re-use in area designated on-site; see Section 31 23 23, Fill.
- B. Remove excavated material unsuitable for re-use from site.
- C. Remove excess excavated material from site.

3.8 PROTECTION

- A. Keep excavations free of standing water.
- B. Maintain stability of banks and loose soils; prevent from falling into excavations.
- C. Maintain excavations in satisfactory, undisturbed condition.
- D. Protect bottom of excavations from freezing.
- E. Plate or barricade open excavations outside of working hours for pedestrian safety.

END OF SECTION

SECTION 31 23 23

FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Filling and compacting to subgrade.
- B. Filling holes, pits, and excavations generated as a result of removal, demolition, or over-excavation operations.
- C. Slurry Cement Backfill.
- D. Controlled Low-Strength Material (CLSM).

1.2 SECTION EXCLUDES

- A. For earthwork related to underground utility installation, see Section 31 23 33 - Trenching and Backfilling.

1.3 RELATED REQUIREMENTS

- A. Project Geotechnical Report: Geotechnical Engineering and Geohazards Report Update, with Preliminary Percolation Testing Proposed ELOP Center Project, Phase 1A, prepared by Earth Systems Pacific, dated January 19, 2026
- B. Section 01 57 13 - Temporary Erosion and Sediment Control.
- C. Section 01 57 23 - Storm Water Pollution Control.
- D. Section 31 22 00 - Grading.
- E. Section 31 23 16 - Excavation.
- F. Section 31 23 33 - Trenching and Backfilling.
- G. Section 33 41 00 - Subdrainage.

1.4 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop; 2022, with Errata .
- B. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)); 2012 (Reapproved 2021).
- D. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.

- E. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.
- F. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2017, with Editorial Revision (2018).
- G. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2023.
- H. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025.
- I. California Building Code (CBC) - California Code of Regulations (CCR), Title 24, Part 2 - California Building Code; Current Edition.
- J. Caltrans Corrosion Guidelines - Caltrans Corrosion Guidelines; 2021.
- K. Caltrans Standard Specifications - Caltrans Standard Specifications; Current Edition.
- L. Department of Toxic Substances Control (DTSC) Regulations - California Code of Regulations (CCR), Title 22, Part 4.5 - Environmental Health Standards for the Management of Hazardous Waste; Current Edition.
- M. NRMCA CLSM - Guide Specification for Controlled Low Strength Materials; Current Edition.

1.5 SUBMITTALS

- A. Submittal Notation: Submittal documents to include specification number and title, and description of item of work covered.
- B. Soil Samples: 10 pounds sample of each type of fill; submit in air-tight containers to testing laboratory if required by the Geotechnical Engineer.
- C. Materials Sources: Submit name and location of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

1.6 QUALITY ASSURANCE

- A. Conform all work in accordance with:
 - 1. Project Geotechnical Report.
 - 2. Caltrans Standard Specifications, Section 17, General and Section 19, Earthwork.
 - 3. California Building Code (CBC), Chapter 18, Soils and Foundations and Chapter 33, Safeguards During Construction.
- B. Perform earthwork under the observation and testing of the Geotechnical Engineer or an independent testing firm, for conformance with the Project Drawings, Specifications, and Geotechnical Recommendations.
 - 1. This includes site preparation, selection of satisfactory materials, and placement and compaction of the subgrades and fills.

2. Notify the Geotechnical Engineer or independent testing firm before starting earthwork. Confirm the required advance notification time with the respective party.
 3. Materials placed without approval of the Geotechnical Engineer or independent testing firm will be presumed to be defective and, at the discretion of the Geotechnical Engineer or independent testing firm, shall be removed and replaced at no cost to the Owner.
 4. Correct earthwork that, in the opinion of the Geotechnical Engineer or independent testing firm, does not meet the requirements of these Technical Specifications and the Geotechnical Report.
 5. The Contractor is responsible for the stability of fills and backfills constructed by his forces. Replace portions that in the opinion of the Geotechnical Engineer or independent testing firm have been displaced or are otherwise unsatisfactory due to the Contractor's operations.
- C. If the Owner's Representative does not provide a Geotechnical Engineer onsite for soil testing, hire an independent testing firm specializing in performing testing and inspections of the type specified in this section.
1. Qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 .

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Control fugitive dust emissions from dumping materials.
- B. When fill materials need to be stored on site, locate stockpiles in an orderly and safe manner where designated.
1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 2. Prevent contamination.
 3. Protect stockpiles from erosion and deterioration of materials in accordance with Section 01 57 13.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. General: On-site (native) soils are considered suitable for use as fill with the following requirements:
1. Free of lumps larger than 3 inches, rocks larger than 3 inches, and debris.
 2. Comply with Geotechnical Recommendations.
 3. Do not use highly expansive soils as backfill for trenches within hardscape areas.
- B. Imported Fill: Approved soil material imported from off-site, if required, should comply with the following requirements unless otherwise noted in the Project Geotechnical Report:
1. Free of organics, debris, and rocks over 3 inches in size.
 2. Obtain Geotechnical Engineer approval before importing to the site.
 3. Non-expansive with:
 - a. Plasticity Index less than 15 as determined by ASTM D4318.
 - b. Fines content between 15 and 65 percent.

4. Non-hazardous complying with Department of Toxic Substances Control (DTSC) Regulations.
5. Non-corrosive per Caltrans Corrosion Guidelines.
- C. Slurry Cement Backfill (2 Sack Slurry): a fluid workable mixture of aggregate, cement, and water in accordance with Caltrans Standard Specifications Section 19-3.02E Slurry Cement Backfill.
 1. Minimum cement: 188 pounds per cubic yard.
- D. Controlled Low-Strength Material (CLSM): a fluid workable mixture of aggregate, cement, and water in accordance with Caltrans Standard Specifications Section 19-3.02G Controlled Low-Strength Material.
 1. Compressive strength at 28 days: 50 to 150 psi.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that survey benchmarks and intended elevations for the Work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.
- C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected, if required.
- D. Verify structural ability of unsupported walls to support imposed loads by the fill.
- E. Verify areas to be filled are not compromised with surface or ground water.

3.2 PREPARATION

- A. Scarify subgrade surface to a depth of 8 inches to identify soft spots and uniformly moisture condition the scarified surfaces to a moisture content that is at least 2 percent over optimum.
- B. Step or bench sloped surfaces steeper than 1 vertical to 4 horizontal, unless otherwise indicated in the geotechnical report, prior to scarifying.
- C. Cut out soft areas of subgrade not capable of compaction in place and backfill.
- D. Compact subgrade to density equal to or greater than requirements for subsequent fill material, unless otherwise noted.
- E. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.
 1. Maintain the subgrade in a moist condition by periodically sprinkling water before placing additional fill or installing roads.
 2. If the subgrade dries out, loosens, or develops desiccation cracking, then scarify, moisture condition, and re-compact it as recommended above.
- F. Prevent erosion and stormwater pollution in accordance with Section 01 57 13 and Section 01 57 23.
- G. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.

- H. Obtain the Geotechnical Engineer's approval of soil surface prior to placement of fill material or pavement structural section.

3.3 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Do not backfill around, against, or upon concrete or masonry structures until they have attained sufficient strength to withstand imposed loads, in accordance with the specifications or as determined by the Design Engineer, and the horizontal structural system is installed.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
 - 1. Adjust soil moisture content during compaction as per geotechnical recommendations, which may include adding water and mixing for dry soils, or scarifying and aerating for wet soils.
 - 2. Wet weather: Do not prepare subgrade, place or compact soil materials if subgrade or materials are above optimum moisture content.
 - a. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.
- F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
 - 1. Each lift should be thoroughly moisture conditioned and compacted before successive fill layers are placed.
- G. Grade in accordance with Section 31 22 00 - Grading.
- H. Backfill trenches in accordance with Section 31 23 33 - Trenching and Backfilling.
- I. Correct areas that are over-excavated.
 - 1. Fill flush to required elevation, compacted to minimum 95 percent of maximum dry density, unless otherwise specified or indicated by the Geotechnical Engineer.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. At other locations: 90 percent of maximum dry density.
 - 3. Perform compaction using rollers, pneumatic or vibratory compactors, or other equipment and mechanical methods approved by the Geotechnical Engineer.
 - 4. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- K. Environmental Requirements: If unfavorable weather interrupts earthwork operations, take measures to prevent over-saturation of the working surface.
 - 1. Provide temporary drainage to prevent erosion.
 - 2. Cover the subgrade or compact and grade the area to avoid water collection.

3. After interruption, re-establish compaction in the last layer before resuming work.

- L. Reshape and re-compact fills affected by vehicular traffic, adverse environmental conditions, or contamination as determined by the Geotechnical Engineer.
- M. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Geotechnical Engineer.
 - 1. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.4 CONTROLLED LOW-STRENGTH MATERIAL (CLSM)

- A. Install fill according to manufacturer's written instructions and in accordance with NRMCA CLSM .
- B. Use batching, mixing, and placing equipment approved by the manufacturer.
- C. Prevent segregation of material.
- D. Tolerance: Finished surface within 1 inch of elevation indicated on drawings.

3.5 SLURRY CEMENT BACKFILL

- A. Install slurry cement backfill in abandoned piping or as indicated on drawings in accordance with Caltrans Standard Specifications Section 19-3.03F Slurry Cement Backfill.

3.6 TOLERANCES

- A. Top Surface of Fill:
 - 1. Building and paved areas: ± 0.05 feet
 - 2. Other areas: ± 0.10 feet

3.7 FIELD QUALITY CONTROL

- A. Soil Fill Materials:
 - 1. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
 - 2. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor") or AASHTO T 180.
 - 3. If tests indicate work does not meet specified requirements, remove work, replace and retest.
 - 4. Frequency of Tests, unless otherwise directed by the Geotechnical Engineer or independent testing firm:
 - a. Soil for structures and pavement: One test per 2,500 square feet, or fraction thereof, of each lift of fill
 - b. Soil outside of structures and pavement: One test per 10,000 square feet, or fraction thereof, of each lift of fill.

3.8 CLEANING

- 1. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Excavation, bedding, cover, backfill, and compaction for site water, sanitary sewer, and stormwater utilities, up to 5 feet outside buildings and up to public utility connections.
- B. Underground warning tape and buried detection wire.
- C. Control of water and dewatering.

1.2 SECTION EXCLUDES

- A. Drainage fill material and placement around subdrains; see Section 33 46 00 – Subdrainage.
- B. Excavation, bedding, cover, backfill, and compaction for underground HVAC, electrical, communication, gas, hydrocarbon, and hydronic and steam energy utilities.

1.3 RELATED REQUIREMENTS

- A. Project Geotechnical Report: Geotechnical Engineering and Geohazards Report Update, with Preliminary Percolation Testing Proposed ELOP Center Project, Phase 1A, prepared by Earth Systems Pacific, dated January 19, 2026
- B. Section 01 57 13 - Temporary Erosion and Sediment Control
- C. Section 01 57 23 - Storm Water Pollution Control
- D. Section 31 10 00 - Site Clearing.
- E. Section 31 22 00 - Grading.
- F. Section 31 23 19 - Dewatering.
- G. Section 33 46 00 - Subdrainage

1.4 DEFINITIONS

- A. Backfill: Material placed above the pipe bedding and cover, extending up to the subgrade of surface material, subgrade of surface facility, or finish grade.
- B. Bedding: Material from the bottom of the trench to the bottom of the utility.
- C. Cover: Continuation of the bedding material, covering the pipe from the bottom of the pipe to the start of the backfill material.

1.5 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop; 2025.

- B. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)); 2012 (Reapproved 2021).
- D. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.
- E. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2025.
- F. ASTM D6103/D6103M - Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM); 2017, with Editorial Revision (2021).
- G. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2023.
- H. Cal/OSHA - California Occupational Safety and Health Administration Title 8 Regulations; Current Edition.
- I. California Building Code (CBC) - California Code of Regulations (CCR), Title 24, Part 2 - California Building Code; Current Edition.
- J. Caltrans Standard Specifications - Caltrans Standard Specifications; Current Edition.
- K. NRMCA CLSM - Guide Specification for Controlled Low Strength Materials; Current Edition.

1.6 SUBMITTALS

- A. Submittal Notation: Submittal documents to include specification number and title, and description of item of work covered.
- B. Samples: 10 pound sample of each type of fill; submit in air-tight containers to testing laboratory if required by the Geotechnical Engineer.
- C. Source Quality Control Submittals: Submit name and location of imported materials source.
 - 1. Results of gradation tests on proposed and actual materials used.
- D. Field Quality Control Submittals:
 - 1. Results of compaction density tests.
- E. Excavation Support Details and Calculations:
 - 1. If requested by the Owner's Representative, submit excavation support design details and calculations prepared and stamped by a registered civil or structural engineer licensed in State where the Project is located. Submittals may be reviewed by the Geotechnical Engineer, Consulting Engineer, and/or the Authorities Having Jurisdiction.
 - 2. Include the basic design, assumed soil conditions, estimated forces, noted safety factors, dewatering related requirements, and plans and specifications of materials and methods.
 - 3. Include the minimum lateral clearance from the edge of excavation support systems for vehicle access, construction equipment operation, and material stockpiling.
 - 4. Do not proceed with excavations until the Owner's Representative responds to the

submittal.

1.7 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Project Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Conform all work in accordance with:
 - 1. Project Geotechnical Report.
 - 2. Caltrans Standard Specifications, Section 17, General and Section 19, Earthwork.
 - 3. California Building Code (CBC), Chapter 18, Soils and Foundations and Chapter 33, Safeguards During Construction.
- C. Perform trench backfilling under the observation and testing of the Geotechnical Engineer, or independent testing firm if applicable, for conformance with the Project Drawings, Specifications, and Geotechnical Recommendations.
 - 1. Trench backfilling must meet the approval of the Geotechnical Engineer, or independent testing agency if applicable. This includes site preparation, selection of satisfactory materials, and placement and compaction of the backfill.
 - 2. Notify the Geotechnical Engineer or independent testing firm before starting work. Confirm the required advance notification time with the respective party.
 - 3. Materials placed without approval of the Geotechnical Engineer or independent testing firm will be presumed to be defective and, at the discretion of the Geotechnical Engineer or independent testing firm, shall be removed and replaced at no cost to the Owner.
 - 4. Correct trench backfill that does not meet the requirements of these Technical Specifications and the Project Geotechnical Report, as determined by the Geotechnical Engineer, or independent testing firm if applicable.
- D. If the Owner's Representative does not provide a Geotechnical Engineer onsite for soil testing, hire an independent testing firm specializing in performing testing and inspections of the type specified in this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Control fugitive dust emissions from dumping materials.
- B. When fill materials need on-site storage, locate stockpiles in an orderly and safe manner.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Import Materials: Obtain Geotechnical Engineer approval before importing to the site.
- B. Utility Bedding and Cover:
 - 1. Graded in accordance with ASTM D2321 Class IA, IB, or II.

- a. Clean and free of clay, silt or organic matter.
 2. Permeable Material: Graded in accordance with Section 68-2.02F of Caltrans Standard Specifications, Class 1, Type A or Class 2.
 3. Class 2 Aggregate Base: Graded in accordance with Section 26 of Caltrans Standard Specifications, $\frac{3}{4}$ inch maximum.
 4. Sand: In accordance with Section 19-3.02F(2) of Caltrans Standard Specifications.
- C. Backfill:
1. On-site (native) soils or imported fill in conformance with requirements in Section 31 23 23 and Geotechnical Recommendations.
 2. Do not use highly expansive soils as backfill for trenches within hardscape areas.
- D. Flowable Fill: See Section 31 23 23 for slurry cement backfill (2 sack slurry) or controlled low-strength material (CLSM).
- E. Concrete Structure Bedding and Backfill
1. Precast Structures: Use materials specified above for Utility Bedding and Cover. Obtain approval from the Geotechnical Engineer for any alternative materials.
 2. Poured-in-Place Structures:
 - a. Bedding: Obtain approval from the Geotechnical Engineer for bedding. Generally, bedding is not required. Pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
 - b. Side Backfill: On-site or imported fill meeting the requirements given in Section 31 23 23.

2.2 ACCESSORIES

- A. Underground Warning Tape: Suitable for direct burial.
1. Bright-colored, continuously printed plastic ribbon tape, minimum 3 inches wide by 4 mils, 0.004 inch thick.
 - a. Color code for intended utility per Color Code Table.
 - b. Warning and identification printed in black bold letters to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording.
 - c. Color and printing shall be permanent, unaffected by moisture or soil.
 - d. For Metallic Piping: Acid and alkali-resistant polyethylene plastic tape with minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
 - e. For Non-Metallic Piping: Polyethylene plastic tape with minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.
- B. Buried Detection Wire: Copper or copper-clad steel, single strand, continuously insulated, 12 AWG 12 AWG, rated for direct burial.
1. Color code for intended utility per Color Code Table.

C. Warning Tape and Detection Wire Color Code Table:

Color	Utility
Red	Electric
Yellow	Gas, Oil; Dangerous Materials
Orange	Communication, Alarm, or Signal Lines, Cables, or Conduit
Blue	Potable Water
Purple	Reclaimed Water, Irrigation, and Slurry Lines
Green	Sewers and Drain Lines
White	Steam Systems
Gray	Compressed Air

2.3 GEOSYNTHETICS

A. Filter Fabric

1. Caltrans Filter Fabric complying with Caltrans Standard Specifications Section 96-1.02B Filter Fabric.
2. Mirafi 140N manufactured by TenCate Geosynthetics America.

2.4 SOURCE QUALITY CONTROL

- A. Nonconforming Materials: Change and retest.
- B. Provide materials of each type from same source or as directed by Owner's Representative.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify survey benchmarks and intended elevations for work are as indicated on drawings.
- B. Verify prevailing groundwater level is as indicated.
- C. Perform assessment of adjacent structures and exterior improvements to establish existing conditions. Notify Owner's Representative in writing of existing cracks, sags, or other damages, as well as discrepancies in site conditions, prior to starting work.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 10 00 for site clearing and topsoil removal.
- C. Protect survey benchmarks, control points, and monuments from excavating equipment and vehicular traffic.
- D. Protect existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Protect trees, plants, lawns, rock outcroppings, and other features to remain.
1. No grading is permitted under the drip line of protected trees, unless approved otherwise by the Arborist.

- F. Locate and identify existing utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.
 - 1. Notify Underground Service Alert - Call Before You Dig (811) to request approximate underground utility marking.
 - 2. Pothole or excavate at locations indicated on the drawings and where new lines cross other utilities of uncertain depth. Determine the elevation of the utility to ensure the new line will clear the potential obstruction.
 - a. If a crossing utility presents an obstruction, notify the Owner's Representative and Engineer immediately and adjust the line and grade of the new line as directed.
 - 3. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Owner's Representative and then only after acceptable temporary utility services have been provided.
- G. Prevent erosion and stormwater pollution in accordance with Section 01 57 13 and Section 01 57 23.

3.3 SUPPORT AND PROTECTION

- A. Excavation Safety: Comply with Cal/OSHA.
- B. Designate a Cal/OSHA competent person responsible for planning and inspecting excavations to ensure compliance with Cal/OSHA regulations, including soil type determinations.
- C. Be responsible for all bracing and shoring, including the preparation of excavation support details and calculations as required.
- D. Protect open trenches with barriers, covers, or other methods to maintain safe pedestrian and vehicular traffic passage. Safely direct vehicular and pedestrian traffic through or around work area at all times.
- E. Provide trench crossings and free access at all street crossings, driveways, water gate valves, and fire hydrants.
- F. Place and maintain bracing and shoring as required to support the sides of the excavations for the protection of workers, to facilitate the work, to prevent damage to the facility being constructed, and to prevent damage to adjacent structures or facilities.
- G. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.
- H. Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.
- I. Install and extract sheathing without disturbing the line, grade, backfill compaction, or operation of the utility being installed or adjacent utilities and facilities.
- J. Remove support and protection systems not required to remain in place, unless approved otherwise by Owner's Representative.

3.4 CONTROL OF WATER AND DEWATERING

- A. Comply with Section 31 23 19, Dewatering, if dewatering is necessary.
- B. Prevent surface water and groundwater from entering excavations and surrounding areas.
- C. Be responsible for dewatering trenches to the satisfaction of the Geotechnical Engineer and the Owner's Representative until backfilling is completed.
- D. Remove water encountered in the trench during pipe laying, bedding, and backfill operations. Ensure material is sufficiently dry to permit approved jointing.
- E. Obtain the Geotechnical Engineer's approval for proposed water control and dewatering methods.
- F. Dispose of water without causing surface erosion, sediment buildup, or endangering public health or property.
- G. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.5 TRENCH EXCAVATION

- A. Grade top perimeter of excavation to prevent surface water collection.
- B. Notify the Owner's Representative immediately, both verbally and in writing, of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
 - 1. No claims for differing conditions will be allowed unless written notice is given before starting work on affected items.
 - 2. If uncharted or incorrectly charted piping or other utilities are encountered during excavation, immediately consult the governing utility agency, if applicable, for directions.
 - 3. Cooperate with the Owner's Representative and public and private utility companies to keep their respective services and facilities in operation.
 - 4. Repair damaged utilities to the satisfaction of the agency having jurisdiction.
- C. General: Cut trenches neat and clean to the widths, lines, and grades indicated.
 - 1. For gravity systems, begin excavation at the downstream connection point and proceed upstream.
 - 2. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
 - 3. Do not interfere with the load-bearing angle of foundations. See the Project Geotechnical Report for the soil bearing angle.
 - 4. Cut trenches wide enough to allow inspection of installed utilities.
 - 5. Maximum trench width, unless stated otherwise, to be pipe outside diameter plus 24 inches.
 - 6. Excavate sides of the trench parallel and equal distant from the centerline of the pipe.
 - 7. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length.
 - 8. Hand trim excavations and remove loose matter.

9. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
 10. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater.
- D. Relocate, reconstruct, replace, or repair all improvements disrupted or damaged by trench construction at the Contractor's expense.
- E. Existing Paving and Concrete:
1. Existing pavement over trench shall be saw-cut, removed, and hauled away from the job. Existing pavement shall be neatly saw-cut along the limits of excavations.
 2. Existing concrete over the trench shall be saw-cut to a full depth in straight lines, at a minimum distance of 12 inches beyond the edge of the trench, either parallel to the curb or a right angle to the alignment of the sidewalk.
 3. Boards or other suitable material shall be placed under equipment outrigging to prevent damage to paved surfaces.
- F. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
1. Use hand or light equipment, which includes air-spade, for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
 2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
 3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
 4. Report damage of utility line or subsurface structures immediately to the Owner's Representative.
- G. Utility Subgrade Preparation: Rake and prepare trench bottom to provide a firm and uniform bearing throughout the entire pipe length.
1. Remove unsuitable subgrade and backfill.
 2. Compact subgrade to density equal to or greater than subsequent fill material requirements.
- H. Maintain trenches and prevent loose soil or rocks from entering.
- I. Excavated Material:
1. Remove excavated material that is unsuitable for re-use from site and dispose of it legally.
 2. Remove excess excavated material from site and dispose of it legally.
 3. Place excavated material from streets and roadways alongside the trench, at least 2 feet from the trench edge. Keep the material trimmed to minimize inconvenience to public traffic.
 4. Ensure that all storm and wastewater can flow uninterrupted in gutters or drainage channels.
- J. Backfill excavations as promptly as work permits.

3.6 UTILITY BEDDING AND COVER

- A. Remove all debris and deleterious material prior to placing bedding and backfill.
- B. Shape bedding material accurately to the line and grade indicated on the drawings.
- C. Fill bedding and cover material to the elevation shown on the drawings and compact in layers not exceeding 8 inches in loose thickness.
 - 1. Compact bedding material at optimum water content to 90 percent relative compaction unless specified otherwise on the drawings or by the Geotechnical Engineer.
 - 2. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of bedding material will not be permitted.
- D. Place bedding material in the trench and tamp to bring the trench bottom up to the grade of the bottom of the pipe.
- E. Fill utility cover simultaneously on both sides of the pipe to prevent displacement from its true alignment.

3.7 FLOWABLE FILL

- A. Completely cover utilities in accordance with NRMCA CLSM. Fill trench to indicated elevation.
- B. Place slurry cement backfill in accordance with Caltrans Standard Specifications Section 19-3.03F Slurry Cement Backfill.
- C. Place controlled low strength material (CLSM) in accordance with Caltrans Standard Specifications Section 19-3.03I Controlled Low-Strength Material.

3.8 BACKFILL AND COMPACTION

- A. Backfill to contours and elevations indicated on drawings using unfrozen materials.
- B. Fill to subgrade elevations unless otherwise indicated on drawings.
- C. Employ placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth.
- G. Correct areas that are over-excavated.
- H. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. At Other Locations: 90 percent of maximum dry density.
 - 3. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer.

4. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe.
5. Jetting or ponding of subsequent backfill material will not be permitted.
- I. Reshape and re-compact fills subjected to vehicular traffic, adverse weather conditions, or otherwise fouled as determined by the Geotechnical Engineer.
- J. Underground Warning Tape:
 1. Install approximately 1 foot above and along the centerline of the buried pipe.
 2. Where tape is not continuous, lap tape ends a minimum of 2 feet.
- K. Buried Detection Wire:
 1. Install directly above buried nonmetallic pipe and connect to all valves, existing exposed tracer wires, and other appurtenances as appropriate.
 2. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 3. Attach the wire to top of pipe in such manner that it will not be displaced during construction operations.
 4. Ensure the wire forms a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance.
 - a. Extend the wire up the outside of the valve box or riser, cut a hole eight inches from the top, and extend a twelve-inch wire lead inside the box.
 - b. At other pipeline appurtenances, terminate the twelve-inch wire lead inside the enclosure.
 5. Splice the wire using a splicing device with an electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

3.9 FIELD QUALITY CONTROL

- A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 modified proctor or AASHTO T 180.
- C. Nonconforming Work: For failed tests, remove work, replace, and retest.
- D. Frequency of Tests: One test every 100 feet, or fraction thereof, at subgrade, top of bedding, mid-point of backfill, and top of backfill, or as directed by the Geotechnical Engineer or independent testing firm.

3.10 CLEANING

- A. Upon completion of utility earthwork, thoroughly clean all lines, manholes, catch basins, inlets, water meter boxes, and other structures to the satisfaction of the Owner's Representative.
- B. Stockpile excavated material re-used in area designated on-site; see Section 31 23 23.
- C. Remove excavated material from the site that is not required or is unsuitable for re-use.

3.11 PROTECTION

- A. Divert surface water away from excavations.
- B. Keep excavations free of standing water.
- C. Maintain stability of banks and loose soils; prevent from falling into excavations.
- D. Maintain excavations in neat and square, undisturbed condition.
- E. Protect bottom of excavations from freezing.

END OF SECTION

SECTION 32 11 00
PAVEMENT BASE COURSE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aggregate subbase
- B. Aggregate base
- C. Cement treated base
- D. Lime stabilization

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 01 50 50, Erosion Control
- C. Section 31 20 00, Earth Moving

1.3 RELATED DOCUMENTS

- A. Geotechnical Report [Insert Report Title, Company, and Report Date]
- B. ASTM:
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
 - 3. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 4. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- C. Caltrans Standard Specifications, 2015
 - 1. Section 24, Stabilized Soils
 - 2. Section 25, Aggregate Subbases
 - 3. Section 26, Aggregate Bases
 - 4. Section 27, Cement Treated Bases

1.4 DEFINITIONS

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an

independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.

- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials. Perform work in accordance with Section 31 20 00, Earth Moving.

1.5 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.6 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.
- C. Perform installation of base materials under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the Owner. Notify the Geotechnical Engineer at least 24 hours prior to commencement of base material installation and at least 48 hours prior to testing.
- D. Do not mix or place cement treated base when the temperature is below is below 36 degrees F or when the ground is frozen.
- E. Finish surface of material to be stabilized prior to lime treatment shall be in accordance with Caltrans Standard Specification Section 24, Stabilized Soils.
- F. Finish surface of the stabilized material after lime treatment shall be in accordance with Caltrans Standard Specifications Section 24, Stabilized Soils.
- G. Finish surface of cement treated base shall be in accordance with Caltrans Standard Specification Section 27, Cement Treated Bases.
- H. Do not project the finish surface of aggregate subbase above the design subgrade.
- I. Finish grade tolerance at completion of base installation: +0.05 feet

1.7 PROJECT CONDITIONS

- A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

- B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Owner.
- C. Provide dust and noise control in accordance with Section 01 10 00, Supplemental General Requirements.

PART 2 PRODUCTS

2.1 AGGREGATE SUBBASE

- A. Material: Class 2 in accordance with Caltrans Standard Specification Section 25, Aggregate Subbases.

2.2 AGGREGATE BASE

- A. Material: Class 2, 1 ½ inch maximum or ¾ inch maximum in accordance with Caltrans Standard Specification Section 26, Aggregate Bases.

2.3 CEMENT TREATED BASE

- A. Material: Class A maximum in accordance with Caltrans Standard Specification Section 27, Cement Treated Bases.

2.4 LIME STABILIZED SOILS

- A. Material: In accordance with Caltrans Standard Specification Section 24-2, Lime Stabilized Soil.

PART 3 EXECUTION

3.1 GENERAL

- A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.2 WET WEATHER CONDITIONS

- A. Do not place or compact subgrade if above optimum moisture content.
- B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.3 AGGREGATE SUBBASE

- A. Spreading and Compacting: In accordance with Caltrans Standard Specification Section 25-1.03D, Spreading and 25-1.03E, Compacting.

3.4 AGGREGATE BASE

- A. Watering, Spreading and Compacting: In accordance with Caltrans Standard Specification Section 26-1.03D, Spreading and 26-1.03E, Compacting.

3.5 CEMENT TREATED BASE

- A. Proportioning and Mixing Plant-Mixed: In accordance with Caltrans Standard Specification Section 27-1.03D.

3.6 LIME STABILIZATION

- A. Lime stabilization shall conform to Caltrans Standard Specification Section 24, Stabilized Soils, and the following:
 - 1. Add lime in the amount specified by the Geotechnical Engineer.
 - 2. Lime treat subgrade soils from back of curb to back of curb to a depth specified by the Geotechnical Engineer.
 - 3. Mix in two mixing periods, both with the tines lowered to the same depth. Both mixing periods shall be monitored and verified by the Geotechnical Engineer. The second mixing shall occur at about 24 hours after the initial mixing.
 - 4. Compact and grade the lime mixed subgrade immediately after the second mixing.
 - 5. Compact the lime treated subgrade to 93 percent as determined by ASTM D1557.
 - 6. After application of the curing seal, do not allow traffic on the lime treated material for a period of 7 days in lieu of the 3 days specified in Caltrans Standard Specifications, Section 24.
 - 7. Proof-roll the stabilized subgrade after compacting to confirm that a non-yielding surface has been achieved. Yielding areas, if any, shall be mitigated. Mitigation could consist of over-excavation, utilization of stabilization fabric, or chemical treatment. Each case shall be addressed individually in the field by the Geotechnical Engineer.

3.7 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hot Mix Asphalt (HMA) paving.
- B. Hot Mix Asphalt (HMA) overlay.
- C. Asphalt speed bumps.
- D. Adjusting manholes, valves, monument covers and other structures to grade.
- E. Seal coats.

1.2 RELATED REQUIREMENTS

- A. Section 31 22 00 - Grading.
- B. Section 31 23 23 - Fill.
- C. Section 32 11 20 - Subbase and Aggregate Base Courses.

1.3 REFERENCE STANDARDS

- A. Project Geotechnical Report: Geotechnical Engineering and Geohazards Report Update, with Preliminary Percolation Testing Proposed ELOP Center Project, Phase 1A, prepared by Earth Systems Pacific, dated January 19, 2026
- B. AI MS-2 - Asphalt Mix Design Methods; 2015.
- C. ASTM D4748 - Standard Test Method for Determining the Thickness of Bound Pavement Layers Using Short-Pulse Radar; Current Edition.
- D. ASTM 2950 - Standard Test Method for Density of Asphalt Mixtures in Place by Nuclear Methods; Current Edition.
- E. ASTM D979 - Standard Practice for Sampling Bituminous Paving Mixtures; Current Edition.
- F. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples; Current Edition.
- G. ASTM D2041/D2041M - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Asphalt Mixtures; 2019.
- H. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures; Current Edition.
- I. ASTM D2950 - Standard Test Method for Density of Asphalt Mixtures in Place by Nuclear Methods; Current Edition.
- J. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Asphalt Mixture Specimens; Current Edition.

- K. ASTM E3209 - Standard Test Method for Pavement Thickness by Magnetic Pulse Induction; Current Edition.
- L. California Test 375 - Determining the In-Place Density and Relative Compaction of Hot Mix Asphalt Pavement Using Nuclear Gages; Current Edition.
- M. Caltrans Standard Specifications - Caltrans Standard Specifications; Current Edition.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Caltrans Standard Specifications Section 39 Asphalt Concrete and Section 37 Seal Coats.
- B. Mixing Plant: Complying with Caltrans Standards.
- C. Obtain materials from same source throughout.

1.5 SUBMITTALS

- A. Submittal Notation: Submittal documents to include specification number and title, and description of item of work covered.
- B. Job-Mix Design: Certify that each job mix design meets or exceeds specified requirements.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Test Reports: Submit report for each test or series of tests specified.

1.6 FIELD CONDITIONS

- A. Asphalt Surface Course: Minimum ambient air and surface temperatures in accordance with Caltrans Standard Specifications Section 39-2.02C Construction (Type A Hot Mix Asphalt).
- B. Seal Coats: Only place in accordance with the following weather conditions:

Cationic Asphaltic Emulsion Chip Seal: Caltrans Standard Specifications Section 37-2.02C(2) Cationic Asphaltic Emulsions.

Cationic Polymer Modified Asphaltic Emulsion Chip Seals: Caltrans Standard Specifications Section 37-2.03C Construction.

Asphalt Rubber Binder Chip Seal: Caltrans Standard Specifications Section 37-2.04C(3) Asphalt Rubber Binder Application.

Slurry Seals and micro-surfacings: Caltrans Standard Specifications Section 37-3.01C(5)(b) Weather Conditions.

Fog Seal and Flush Coat: Caltrans Standard Specifications Section 37-4.01C(2) Weather Conditions.

- C. Do not place asphalt, tack coat, or seal coats when base surface is wet.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

- A. Comply with applicable code for paving work on public property.

2.2 HOT MIX ASPHALT

- A. Type A in accordance with Caltrans Standard Specifications Section 39-2 Hot Mix Asphalt.

B. Asphalt Binder:

Comply with Caltrans Standard Specifications Section 39-2.01B(3) Asphalt Binder.

Grade PG 70-10 in accordance with Caltrans Standard Specifications Section 92 Asphalt Binders.

C. Aggregates: 3/4 inch gradation for virgin aggregate and recycled asphalt pavement (RAP) in accordance with Caltrans Standard Specifications 39-2.01B(4) Aggregates and Section 39-2.02B(4) Aggregates.

1. Maximum Recycled Asphalt Pavement (RAP): 25 percent of aggregate in accordance with Caltrans Standard Specifications Section 39-2.02B(5) Reclaimed Asphalt Pavement.

D. Tack Coat:

Comply with Caltrans Standard Specifications Section 39-2.01B(10) Tack Coat.

Grade CSS-1 in accordance with Caltrans Standard Specifications Caltrans Standard Specifications Section 94 Asphaltic Emulsions.

E. Miscellaneous Hot Mix Asphalt: Type A Hot Mix Asphalt (HMA) conforming to Caltrans Standard Specifications Section 39-2.01B(11) Miscellaneous Areas and Dikes; 3/8 inch aggregate unless stated otherwise.

F. Geosynthetic Pavement Interlayer: Pavement Fabric in accordance with Caltrans Standard Specifications Section 39-2.01B(9) Geosynthetic Pavement Interlayer and Section 96 Geosynthetics.

2.3 PAVEMENT PRESERVATION

A. Caltrans Seal Coats:

General: Comply with Caltrans Standard Specifications Section 37 Construction (Seal Coats).

Chip Seals: Comply with Caltrans Standard Specifications Section 37-2 Chip Seals.

Slurry Seals and Micro-Surfacings: Comply with Caltrans Standard Specifications Section 37-3 Slurry Seals and Micro-surfacings.

- a. Slurry Seal: Type II, Cationic type asphaltic emulsion Grade PMCQS-1h.

- b. Micro-Surfacing: Type II.

Fog Seals and Flush Coats: Comply with Caltrans Standard Specifications Section 37-4 Fog Seals and Flush Coats.

Parking Area Seals: Comply with Caltrans Standard Specifications Caltrans Standard Specifications Section 37-5 Parking Area Seals.

B. Caltrans Crack Treatment: Comply with Caltrans Standard Specifications Section 37-6 Crack Treatments and Section 37-1 General.

C. OverKote Asphalt Pavement Coating, manufactured by RaynGuard Protective Materials, Inc.

OverKote Crack Treatment: hot or cold applied crack filler compatible with OverKote asphalt pavement coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

- B. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

3.2 PAVEMENT GRINDING

- A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.
- B. Grind surface and conforms as indicated.

3.3 AGGREGATE BASE COURSE

- A. See Section 32 11 20.
- B. Proof-roll subbase and base with heavy rollers to identify unstable areas or zones requiring additional compaction. Do not begin paving until all deficiencies are corrected.

3.4 PREPARATION FOR HOT MIX ASPHALT OVERLAYS

- A. If pavement grinding is not indicated, level pavement irregularities with Hot Mix Asphalt (HMA), Type A, 1/2 inch maximum aggregate.
- B. Pavement Crack Treatment:

Cracks from 1/4 to 1 inch wide: Clean cracks using compressed air to remove dirt and debris. Apply Caltrans crack treatment material in accordance with Caltrans Standard Specifications Section 37-6 Crack Treatments.

Cracks greater than 1 inch wide: Notify the Owner's Representative for direction.

- C. Cover manholes, valve and monument covers, grates, or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured by tape or adhesive to the facility being covered.

Reference the covered facilities with enough control points to relocate the facilities after application. Prior to final set of HMA, uncover all covered appurtenances and clean.

- D. Clean surface of all material, such as leaves, dirt, sand, gravel, water and vegetation prior to applying tack coat to existing surface.

3.5 PREPARATION - TACK COAT

- A. Apply tack coat at a uniform rate in accordance with Caltrans Standard Specifications Section 39-2.01C(3)(f) to the following:

Existing pavement, including planed surfaces

Between HMA layers

To contact surfaces of curbs, gutters and construction joints.

- B. Coat surfaces of manhole frames, grates, and other appurtenances with oil or cover to prevent bond with asphalt pavement. Do not tack coat these surfaces.
- C. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Allow tack coat to cure undisturbed before paving.

3.6 GEOSYNTHETIC PAVEMENT INTERLAYER

- A. Where shown, place geosynthetic pavement interlayer in accordance with Caltrans Standard Specification Section 39-2.01C(3)(g) Geosynthetic Pavement Interlayer.

3.7 HOT MIX ASPHALT SPREADING AND COMPACTING EQUIPMENT

- A. Provide spreading and compacting equipment in accordance with Caltrans Standard Specification Section 39-2.01C(2) Spreading and Compacting Equipment.

3.8 PLACING ASPHALT PAVEMENT

- A. Place, spread and compact hot mix asphalt to required grade, cross section, and thickness in accordance with Caltrans Standard Specifications Section 39-2.01C Construction (Hot Mix Asphalt) and Section 39-2.02C Construction (Type A Hot Mix Asphalt).
- B. Place asphalt within 24 hours of applying tack coat.
- 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 asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 COMPACTION

- A. Compact pavement by rolling to specified density in accordance with Caltrans Standard Specifications Section 39-2.01C(15) Compaction.
- B. Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Do not displace or extrude pavement from position.
- C. Density Requirements: 95.0 percent of maximum theoretical density.
- D. Hand compact in areas inaccessible to rolling equipment.
- E. Finish Rolling: Perform rolling with consecutive passes while asphalt is still warm to achieve even and smooth finish without roller marks.
- F. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment.

Bevel edges while still hot, with back of rake or smooth iron.

Compact thoroughly using tamper or other satisfactory method.

- G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.

3.10 JOINTS

- A. Construct joints to ensure continuous bond between adjoining paving sections in accordance with Caltrans Standard Specification Sections 39-2.01C(4) Longitudinal Joints.
- B. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
- C. Clean contact surfaces and apply tack coat.

- D. Offset longitudinal joints in successive courses a minimum of 6 inches.
- E. Offset transverse joints in successive courses a minimum of 24 inches.
- F. Compact joints as soon as hot mix asphalt will bear roller weight without excessive displacement.

3.11 SPEED BUMPS - MISCELLANEOUS HOT MIX ASPHALT

- A. Construct speed bumps using Miscellaneous Hot Mix Asphalt over compacted pavement surfaces in accordance with Caltrans Standard Specification Section 39-2 Hot Mix Asphalt.
- B. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- C. Place asphalt concrete by hand using a template/screed designed to result in speed bump cross-section indicated after compaction.
- D. Compact speed bumps with 8 ton static roller.

3.12 ADJUSTING MANHOLES, VALVES, MONUMENT COVERS AND OTHER STRUCTURES TO GRADE

- A. Comply with requirements of authorities having jurisdiction.
- B. Remove pavement, using vertical cuts, as needed to remove frame and provide for concrete collar. Do not damage adjacent pavement.

Circular Covers: Cut circle with radius 6 inches larger than cover and concentric with cover.

Rectangular Covers: Cut rectangle 6 inches larger than cover on all sides.

- C. Install grade rings or blocking as needed to raise cover to finish grade.

- D. Pour concrete collar:

Bottom of Collar: Top of existing collar or 6 inches below top of proposed collar, whichever is at a higher elevation.

Top of Collar: Bottom of existing asphalt pavement.

- E. Apply tack coat to all exposed surfaces and fill excavation with hot mix asphalt.

While still hot, compact flush with adjacent surface.

3.13 SEAL COATS

- A. General: Apply Caltrans Seal Coats in accordance with Caltrans Standard Specifications Section 37 Seal Coats.
- B. Surface Preparation for Existing Asphalt Pavement:

Remove existing striping and pavement markers prior to application. Apply seal coat within 72 hours after the removal of striping and pavement markers.

- a. Test thermoplastic paint for hazardous materials prior to removal.

Crack Treatment:

- b. Caltrans Seal Coats: If cracks in the existing pavement are from 1/4 to 1 inch wide, treat the cracks in accordance with Caltrans Standard Specifications Section 37-6 Crack Treatments. Do not place the seal coat until the crack treatments are cured.
 - 1) If cracks in the existing pavement are greater than 1 inch wide, notify the Owner's Representative for direction.
- c. OverKote Seal Coat: Treat cracks in accordance with manufacturer's instructions.

Cover manholes, valve and monument covers, grates, or other exposed facilities located within the area of application, using a plastic or oil resistant construction paper secured by tape or adhesive to the facility being covered.

- d. Reference the covered facilities with enough control points to relocate the facilities after application.
- e. Prior to the final set of seal coat, uncover all covered appurtenances and clean.

Immediately before applying seal coats to existing pavement, clean the surface to receive the seal coat and remove any extraneous material affecting adhesion with the existing surface, including removal of oil and grease spots.

- f. Do not use solvents. If cleaning the pavement with detergents, thoroughly rinse with water.
- g. You must seal oil and grease spots that remain after cleaning. Use an oil seal primer and comply with the manufacturer's instructions.
- h. Allow all water to dry before placing seal coats.
- i. Remove all organic plant material growing in the pavement, at the interface of the asphalt surface with edges of concrete, and within the gutter expansion joints.
- j. Gather and properly dispose of all removed material.

C. Application:

If required, align joints between applications with lanes of traffic or parking stall lines.
The seals must be uniform and smooth, free of ridges or uncoated areas.
Spills onto gutters and other adjacent concrete must be cleaned immediately.

- D. Protection: Do not permit vehicular traffic on pavement until it has cooled and hardened, for 24 hours minimum or per manufacturer's recommendation, whichever is longer.

Coordinate closure for application and curing with affected businesses and local agencies such as garbage, fire department, etc.

- E. Repairs: Repair early distresses in accordance with Caltrans Standard Specification Section 37 Seal Coats.

3.14 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Compacted Thickness: Not less than indicated.
- C. Variation from True Elevation: Within 1/2 inch, except within accessibility areas and paths of travel that require meeting accessibility requirements.
- D. Trench Patch: Within 0.01 foot of adjacent pavement after compaction. Do not create ponding.

- E. Adjusted Covers: Up to 0.01 foot higher, and no lower, than adjacent asphalt pavement after compaction. Do not create ponding.

3.15 PROTECTION

- A. Immediately after hot mix asphalt placement, protect pavement from mechanical injury for at least 6 hours and until its mid depth temperature is less than 160 degrees F.

If the surface to be paved is both in sunlight and shade, pavement temperatures are taken in the shade.

- B. Erect barricades to protect paving from traffic until mixture has cooled and hardened enough not to become marked.
- C. Coordinate closure for application and curing with affected businesses and local agencies such as garbage, fire department, etc.

END OF SECTION

SECTION 32 12 36

SEAL COATS

PART 1 GENERAL

1.1 RELATED WORK

- A. Section 31 10 00: Site Preparation
- B. Section 32 12 00: Flexible Paving
- C. Section 32 17 23 01: Traffic Striping and Pavement Markings

1.2 REFERENCES

Current Caltrans Standard Specifications:

- A. Section 37 – Bituminous Seals
- B. Section 92 – Asphalts
- C. Section 93 – Liquid Asphalts
- D. Section 94 – Asphaltic Emulsions

1.3 SUBMITTALS

- A. The Contractor shall furnish material certificates, including mill test reports on the asphalts, emulsions and crack sealers signed by the material producer and the Contractor, showing compliance with the respective specifications.

1.4 PROJECT CONDITIONS

- A. Chip seals shall not be applied until sufficient screenings are on hand to immediately cover the asphaltic emulsion.
- B. Chip seals shall not be applied when the atmospheric temperature is below 18° C/ 65° F or above 43° C/ 110° F, or when the pavement temperature is below 27° C/ 80° F.

PART 2 PRODUCTS

2.1 CHIP SEAL

- A. Liquid asphalt for prime coat, if required, shall be slow cure liquid asphalt, SC-70, conforming to Section 93 of the Caltrans Standard Specifications.
- B. Asphaltic emulsion for the first and second coats shall be Grade CRS2 conforming to the requirements of Section 94 of the Caltrans Standard Specifications. Asphaltic emulsion for the third coat shall be SS1h conforming to the requirements of Section 94 of the Caltrans Standard Specifications.
- C. Screenings shall conform to the following requirements prior to depositing on the roadbed:

1. Screenings shall consist of broken stone, crushed gravel, or both. At least 90 percent by weight of the screenings shall consist of crushed particles as determined by California Test 205.
2. Screenings shall be clean and free from dirt and other deleterious substances.
3. Screenings for single chip shall be 3/8" x No. 6 (medium-graded in conformance with Section 37-1.02 of the Caltrans Standard Specifications) unless otherwise specified.
4. Screenings for double chip shall be graded in conformance with Section 37-1.02 of the Caltrans Standard Specifications:
 - 1st application – 12.5mm x 4.75mm (½ in x No.4) (coarse)
 - 2nd application – 6.33mm x 2.00mm (¼ in x No. 10) (fine)

2.2 CAPE SEAL

- A. Cape seal shall be a single application of chip seal surfaced 1 week later by a slurry seal application.

2.3 CRACK SEALERS

- A. Crack sealers shall be a commercial rubberized asphalt or a liquid asphalt. Acceptable products are Reed & Graham Overkote Crack Filler or approved equal.

2.4 PARKING AREA SEAL COAT

- A. Parking area seal coat shall be a cold applied composition of a refined petroleum asphalt emulsion, fillers and fibers. Asphalt emulsion shall not be of the clay type. Acceptable products are Reed & Graham OverKote Asphalt Pavement Coating or approved equal.

PART 3 EXECUTION

3.1 PREPARATION

- A. Thermoplastic striping, tape, and raised pavement markers shall be removed or protected in conformance with Section 32 17 23 01, Traffic Striping and Pavement Markings.

3.2 PAVEMENT REPAIR

- A. All existing pavement to receive a chip seal, parking lot seal coat, or cape seal shall be repaired as follows prior to commencing resurfacing operations:
 1. Cracks less than ½ inch in width shall be cleared of dirt, dust, and other deleterious materials and repaired with asphalt crack sealer or with slurry seal applied in accordance with the manufacturer's recommendations.
 2. Cracks or holes larger than ½ inch in width shall be cleared of dirt and other deleterious materials and filled with hot asphalt concrete mix.
 3. Areas specified for dig-out shall be excavated to sub-base, or to the depth specified. The sub-base shall be scarified to a depth of 6 inches and compacted to 95 percent density.
 4. The top 2 inches of the patch shall be ½ inch maximum size, medium grade asphalt concrete.
 5. The maximum thickness of any lift of asphalt concrete in dig-outs shall be 3 inches.

3.3 CHIP SEAL

A. Preparation:

1. Before applying asphaltic emulsion, the existing paved surfaces shall be cleaned by sweeping, or other means necessary to remove all loose particles of paving, dirt, and other extraneous material.
2. Before asphaltic emulsion is to be applied to any areas, all utility covers located in the areas to be surfaced shall be covered or oiled. These covers shall be cleaned as quickly as possible after the application of the screenings and prior to final set.
3. When a chip seal is to be applied to an untreated material, a prime coat of liquid asphalt shall be applied to the material in place at a rate of from 0.20 to 0.33 gallons per square yard.

B. Application:

1. Asphaltic emulsion shall be applied in accordance with Caltrans Standard Specifications Section 94. The first application shall be at the rate of 0.25 gallons per square yard. The second application shall be at the rate of 0.20 gallons per square yard. The third application shall be at the rate of 0.10 gallons per square yard.
2. Immediately following the application of the asphaltic emulsion, it shall be covered with screenings at the rate of 23 to 30 pounds per square yard for the first application and 12 to 20 pounds per square yard for the second application. The screenings shall be spread using a chip spreader machine or a spreader box attached to a truck.
3. A pneumatic-tired type roller shall be used to compact the screenings. Drum-type rollers are not acceptable. A minimum of two complete passes is required: The first pass immediately after the screenings are spread and the second pass within four hours. Traffic will not be allowed on the new surface for at least four hours.
4. Surplus gravel materials derived from the process shall be swept using motorized vacuum equipment prior to opening the area up to the public.

3.4 CAPE SEAL APPLICATION

A. Preparation:

1. Preparation for chip seal shall be as per paragraph 3.03 above.
2. Chip seal for cape seal shall be swept 24 hours after application and as necessary prior to slurry seal application. Chip seal shall be swept immediately prior to slurry seal application.

B. Application:

1. Application for chip seal shall be as per paragraph 3.03 above.
2. Application for slurry seal shall be as per Section 32 01 13 61 – Slurry Seal and at least 7 days following application of the standard chip seal, or at least 28 days following application of asphalt rubber chip seal. Speed of slurry seal application trucks must be slow enough to prevent washboard effect from resulting.

3.5 PARKING AREA SEAL COAT

A. Preparation:

1. Before application, the pavement surface shall be cleaned by sweeping, flushing or other means necessary to remove all loose particles of paving, all dirt and all other extraneous

material. All pavement markings shall be removed before application by sandblasting or grinding. Damaged asphalt and areas saturated by oil or grease shall be removed and replaced. Oil, grease and other pollutants shall be prevented from entering the storm drainage system per Special Conditions for Storm Water Pollution Prevention.

B. Application

1. Mixing and agitating equipment shall be a tank-type power mixer with a round bottom, equipped with a power driven mixer of sufficient capacity to maintain the mineral content in complete suspension.
2. Immediately prior to application of the emulsion, the pavement surface shall be dampened as directed by the Project Manager, or as recommended by the manufacturer.
3. The mixture shall be applied by mechanized material-spreading equipment or other approved method in continuous parallel lines and spread immediately by the use of rubber-faced squeegees.
4. Sealer shall be mixed to a uniform free-flowing consistency. Water shall be added in accordance with the manufacturer's specifications (not to exceed 15 percent by volume) to obtain a semi-fluid consistency.
5. Two or more applications shall be made under the direction of the Project Manager such that the result is a smooth, uniform surface.
6. If the surface to be sealed is excessively rough (surface voids greater than 3/16 inch between the top of exposed aggregate to the bottom of the void), the Project Manager may direct the Contractor to add clean 30 mesh sand to the mixture of the first coat at the rate of 3 pounds per gallon.
7. Upon completion of the seal, all traffic shall be excluded from the area for not less than 24 hours, or as directed by Project Manager.

3.6 SURFACE STRUCTURES

- A. The Contractor shall be responsible for referencing, covering and protecting surface structures.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.
- B. Form construction and use in placing portland cement concrete pavement.
- C. Joints for portland cement concrete pavement.
- D. Finishing portland cement concrete pavement.
- E. Curing and protecting portland cement concrete pavement.

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 31 20 00, Earth Moving
- C. Section 32 11 00, Pavement Base Course
- D. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: [Reference Geotechnical Report if relevant for project] [Name, Title, Date].
- B. AASHTO Standard Specifications
 - 1. T132: Standard Method of Test for Tensile Strength of Hydraulic Cement Mortars
- C. ASTM Standards
 - 1. D36: Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
 - 2. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. A706: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
 - 4. A775: Standard Specification for Epoxy Coated Steel Reinforcing Bars.
 - 5. A934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 - 6. A996: Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
 - 7. C94: Standard Specification for Ready-Mixed Concrete
 - 8. C603: Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
 - 9. C639: Standard Test Method for Rheological (Flow) Properties of Elastomeric

Sealants

10. C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
11. C679: ASTM C679-15 Standard Test Method for Tack-Free Time of Elastomeric Sealants
12. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
13. C793: Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
14. C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
15. D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
16. D1640: Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
17. D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
18. D2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
19. D3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
20. D6690: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

D. Caltrans Standard Specifications, 2015

1. Section 10, General
2. Section 40, Concrete Pavement
3. Section 52, Reinforcement
4. Section 95, Epoxy

E. Caltrans Standard Plans:

1. Plan P1: Jointed Plan Concrete Pavement – New Construction
2. Plan P10: Concrete Pavement Dowel Bar Details

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing and Materials
- C. Caltrans: State of California, Department of Transportation

1.5 QUALITY ASSURANCE

- A. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
- C. Installer Qualification: An experienced installer who has completed pavement work similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.6 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.
- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
 - 1. Cementitious materials and aggregates
 - 2. Steel reinforcement and reinforcement accessories
 - 3. Admixtures
 - 4. Curing compound
 - 5. Applied finish material
 - 6. Bonding agent or adhesive
 - 7. Joint filler
 - 8. Joint Sealant
 - 9. Tie Bars
 - 10. Epoxy
 - 11. Backer Rods

PART 2 PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

- A. In accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.2 BASE MATERIAL

- A. In accordance with Section 32 11 00, Pavement Base Course.

2.3 TIE BARS

- A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A615, Grade 40 or 60

B. Epoxy-coat in accordance with Caltrans Standard Specification Section 52-2.02, Epoxy-Coated Reinforcement, except bars must comply with ASTM A706; ASTM A996; or ASTM A615, Grade 40 or 60.

C. Do not bend tie bars.

2.4 EPOXY

A. Bond tie bars to existing concrete with epoxy resin in accordance with Caltrans Standard Specification Section 95-1.02D, Epoxy Adhesive for Bonding Freshly Mixed Concrete to Hardened Concrete.

2.5 SILICONE JOINT SEALANT

A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	45 psi max.
Flow at 77° ± 1°F	ASTM C639 ^a	Shall not flow from channel
Extrusion Rate at 77° ± 1°F	ASTM C603 ^b	75-250 g per min.
Specific Gravity	ASTM D792 Method A	1.01 to 1.51
Durometer Hardness, at 0°F, Shore A, cured 7 days at 77° ± 1°F	ASTM C661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C793	No chalking, cracking or bond loss
Tack free at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM C679	Less than 75 minutes
Elongation, 7 day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	500 percent min.
Set to Touch, at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 77° ± 1°F	AASHTO T132 ^c	50 psi min.
Movement Capability and Adhesion, 100% extension at 0°F after air cured 7 days at 77° ± 1°F, and followed by 7 days in water at 77° ± 1°F	ASTM C719 ^d	No adhesive or cohesive failure after 5 cycles

Notes:

- a. ASTM Designation: C639 Modified (15 percent slope channel A).
 - b. ASTM Designation: C603, through 1/8 inches opening at 50 psi.
 - c. Mold briquets in conformance with the requirements in AASHTO Designation: T132, sawed in half and bonded with a 1/16 inches maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T132. Briquets shall be dried to constant mass at 212 ± 10°F.
 - d. Movement Capability and Adhesion: Prepare 12 inch x 1 inch x 3 inch concrete blocks in conformance with the requirements in ASTM Designation: C719. A sawed face shall be used for bond surface. Seal 2 inch of block leaving 1/2 inches on each end of specimen unsealed. The depth of sealant shall be 3/8 inches and the width 1/2 inches.
- B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.
- C. Furnish to the Owner's Representative a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

2.6 ASPHALT RUBBER JOINT SEALANT

- A. Conform to the requirements of ASTM Designation: D6690 as modified herein or to the following:
 1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that

100 percent will pass a No. 08 sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.

2. The Ring and Ball softening point shall be 135°F minimum, when tested in conformance with the requirements in ASTM D36.
 3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 400°F.
- B. The penetration requirements of Section 4.2 of ASTM Designation: D6690 do not apply. The required penetration at 77°F, 5 oz, 5s, shall not exceed 120.
- C. The resilience requirements of Section 4.5 of ASTM Designation: D6690 do not apply. The required resilience, when tested at 77°F, shall have a minimum of 50 percent recovery.
- D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D6690, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.
- E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the Plans. Provide manufacturer's instructions to the Owner's Representative. Do not place when the pavement surface temperature is below 50 °F.

2.7 PREFORMED COMPRESSION JOINT SEALANT

- A. Material: ASTM Designation: D2628.
1. Number of cells: 5 or 6.
 2. Lubricant Adhesive: ASTM Designation D2835.
 3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacturer's recommendations to the Owner's Representative`.
- B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the Plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the Plans.

2.8 BACKER RODS

- A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

2.9 SLIP RESISTIVE AGGREGATE FINISH

- A. Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed 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.

PART 3 EXECUTION

3.1 WATER SUPPLY

- A. Provide water supply in accordance with Caltrans Standard Specification Section 10-6, Watering.

3.2 SUBGRADE

- A. Prepare subgrade in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.3 SOIL STERILANT

- A. Furnish and apply to areas indicated in accordance with Section 31 20 00, Earth Moving.

3.4 PLACING

- A. Prepare concrete in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.5 SPREADING COMPACTING AND SHAPING

- A. Conform to the following (select one):
 - 1. Stationary Side Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Stationary Side-Form Construction.
 - 2. Slip Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Slip Form Construction.

3.6 INSTALLING TIE BARS

- A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the Plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 50 feet. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.
- B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:
 - 1. Drilling and bonding in conformance with the details shown on the Plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

<u>Temperature of Concrete</u>	<u>Required Class of Epoxy Resin</u>
Lower than 40° F	A
40° F through 60° F	B
Above 60° F	C

- 2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be

cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner's Representative, will be rejected. If rejected, adjacent new holes shall be drilled, as directed by the Owner's Representative, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.

3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

3.7 JOINTS

- A. Construct joints in accordance with Caltrans Standard Specification Section 40-1.03B, Joints, except that tie bars shall be as specified under Part 1, Materials.
 1. Construction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B(2), Construction Joints.
 - a. Construct a construction joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
 - b. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall become the property of the Contractor and shall be properly disposed of.
 - c. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.
 2. Contraction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B (3), Contraction Joints, except that the insert method of forming joints in pavement shall not be used.

3.8 FINISHING

- A. Finish concrete in accordance with Caltrans Standard Specification Section 40-1.03H, Finishing.
- B. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb per 100 sq. ft. dampened, slip-resistive aggregate over paving surface in two 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 paving 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.

3.9 CURING

- A. Cure concrete in accordance with Caltrans Standard Specification Section 40-1.03I, Curing.

3.10 SEALING JOINTS

- A. Liquid Joint Sealant Installation.

1. The joint sealant detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 2 inch on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of $1/4 \pm 1/32$ inches and a minimum pressure of 90-psi.
4. Install backer rod as shown on the Plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 40°F or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.
5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the Plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the Plans.

6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the Plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the Plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
 7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.
- B. Preformed Compression Joint Seal Installation
1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the Plans.
 2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
 3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of $1/4 \pm 1/32$ inches and a minimum pressure of 90 psi.

3.11 PROTECTING CONCRETE PAVEMENT

- A. Protect pavement in accordance with Caltrans Standard Specification Section 40-1.03J Protecting Concrete Pavement.

END OF SECTION

SECTION 32 13 16
DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Colored concrete paving.
2. Stamped concrete paving.
3. Stained concrete paving.

B. Related Requirements:

1. Section 32 13 13 "Concrete Paving" for cast-in-place concrete paving with other finishes, curbs and gutters, and stamped detectable warnings.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to decorative concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and decorative concrete paving construction practices.
2. Require representatives of each entity directly concerned with decorative concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Decorative concrete paving Installer.
 - c. Manufacturer's representative of decorative concrete paving system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of exposed color, pattern, or texture indicated.

C. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Certificates: For the following, from manufacturer:

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.

C. Material Test Reports: For each of the following:

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.
- B. Ready-Mix-Concrete 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" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
 2. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on decorative concrete paving mixtures.

1.8 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced

strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

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 frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete 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 in 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.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves of a radius of 100 feet or less. Do not use notched and bent forms.
- B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.
- C. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 deformed bars; assembled with clips.
- D. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.

- E. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
- F. 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 specified, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.4 RELATED MATERIALS

- A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.
- B. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.5 CONCRETE MIXTURES

- A. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties.
- B. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- 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:
 - a. 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
- D. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- F. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): 3650 psi.
 - 2. Slump Limit: 5 inches, plus or minus 1 inch.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 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.

- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For concrete batches 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 batches 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.
- B. Proof-roll prepared subbase surface below decorative concrete paving 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. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 31 20 00 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides 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 INSTALLATION OF 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. 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 to adjacent mats.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges 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 paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 - 2. Butt Joints: Use epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 3. 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.
 - 4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt 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. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 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. During concrete placement, protect top edge of joint filler 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:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

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.
 - a. Tolerance: Ensure that sawed joints are within 3 inches in both directions from centers of dowels.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- 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. Do not add water to fresh concrete after testing.
- F. 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 and joint devices.
- G. Screed paving surface with a straightedge and strike off.
- H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

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 bleedwater 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.

3.8 INTEGRALLY COLORED CONCRETE FINISH

A. Integrally Colored Concrete Finish: After final floating, apply the following finish:

1. 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.

3.9 PIGMENTED MINERAL DRY-SHAKE HARDENER APPLICATION

A. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match paving color required.
2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
3. After final power floating, apply the following finish:
 - a. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - b. 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.
 - c. 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.

B. Pigmented Powder Release Agent: Uniformly distribute onto dry-shake-hardened and still-plastic concrete at a rate of 3 to 4 lb/100 sq. ft.

C. Liquid Release Agent: Uniformly mist surface of dry-shake-hardened and still-plastic concrete at a rate of 5 gal/1000 sq. ft.

3.10 STAMPING

A. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.

1. Pigmented Powder Release Agent: Uniformly distribute onto concrete at a rate of 3 to 4 lb/100 sq. ft.
2. Liquid Release Agent: Apply liquid release agent to the concrete surface and the stamp mat. Uniformly mist surface of concrete at a rate of 5 gal/1000 sq. ft.
3. After application of release agent, accurately align and place stamp mats in sequence.
4. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

B. Tool Stamping: After floating and while concrete is plastic, apply tool-stamped finish.

1. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles.
 2. Accurately align and place stamp tools in sequence and tamp into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp tools. Hand stamp edges and surfaces unable to be imprinted by stamp tools.
 3. Carefully remove polyethylene film immediately after tool stamping.
- C. Roller Stamping: After floating and while concrete is plastic, apply roller-stamped finish.
1. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles.
 2. Accurately align roller and perform rolling operation to produce required imprint pattern and depth of imprint on concrete surface. Hand stamp surfaces inaccessible to roller.
 3. Carefully remove polyethylene film immediately after roller stamping.

3.11 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 Compound: Apply immediately after final finishing. 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.
1. Cure integrally colored concrete with a pigmented curing compound.
 2. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.
- F. Curing and Sealing 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- G. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over paving edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

3.12 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
1. Elevation: 3/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/2 inch.

4. Lateral Alignment and Spacing of Dowels: 1 inch.
 5. Vertical Alignment of Dowels: 1/4 inch.
 6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 7. Joint Spacing: 3 inches.
 8. Contraction Joint Depth: Plus 1/4 inch, no minus.
 9. Joint Width: Plus 1/8 inch, no minus.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 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; 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 it is 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- D. Strength of each concrete mixture will be satisfactory if 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.
- E. Test results shall be reported in writing to Architect, 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.
- F. 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.
- G. 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 Architect.
- H. Decorative concrete paving will be considered defective if it does not pass tests and inspections.
- I. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

J. Prepare test and inspection reports.

3.13 REPAIR AND PROTECTION

- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.
- C. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 13 18

PORTLAND CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials for portland cement concrete
- B. Aggregate and aggregate grading for portland cement concrete
- C. Water for portland cement concrete
- D. Admixtures for portland cement concrete
- E. Proportioning for portland cement concrete
- F. Mixing and transporting portland cement concrete
- G. Formwork for cast in place portland cement concrete
- H. Embedded materials for portland cement concrete
- I. Steel reinforcement for portland cement concrete
- J. Placing and finishing portland cement concrete
- K. Curing portland cement concrete
- L. Protecting portland cement concrete

1.2 RELATED SECTIONS

- A. Section 32 12 16, Asphalt Paving
- B. Section 32 13 13, Concrete Pavement

1.3 RELATED DOCUMENTS

- A. ASTM Standards
 - 1. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 3. C94, Standard Specification for Ready-mixed Concrete
 - 4. C150, Standard Specification for Portland Cement
 - 5. C260, Standard Specification for Air-Entraining Admixtures for Concrete
 - 6. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - 7. C494, Standard Specification for Chemical Admixtures for Concrete.
 - 8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan

for use in Portland Cement

9. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
 10. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
 11. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- B. Caltrans Standard Specifications, 2018
1. Section 51: Concrete Structures
 2. Section 73: Concrete Curbs and Sidewalks
 3. Section 90: Concrete

1.4 DEFINITIONS

- A. ASTM: American Society for Testing and Materials

1.5 SUBMITTALS

- A. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the Plans. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.
- B. Reinforcing Steel Shop-Drawings

1.6 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.
- B. Certifications:
1. Provide Owner's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
 - c. Statement of type and amount of any admixtures.
 2. Provide Owner's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.7 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall be considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.
- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT

- A. General: Type II or Type V cement conforming to the requirements of ASTM C150. Contractor may substitute pozzolan for portland cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C618.

2.2 AGGREGATE AND AGGREGATE GRADATION

- A. General: Fine and coarse aggregates shall be $\frac{3}{4}$ inch maximum size; clean and crushed aggregate free of materials which may cause staining. Aggregates shall conform to the requirements of section 90-1.02C of the Caltrans Standard Specifications.
- B. Aggregate Size and Gradation: Conform to the requirements of section 90-1.02C(4)(d) of the Caltrans Standard Specifications for 1 inch maximum combined aggregate.

2.3 WATER

- A. General: Water shall be clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material, and not detrimental to concrete per ASTM C94. Water shall conform to the requirements of section 90-1.02D of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

2.4 CHEMICAL ADMIXTURES

- A. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Admixtures shall conform to the requirements of section 90-1.02E of the Caltrans Standard Specifications and as noted herein or on the Plans.
 - 1. Air-Entraining Admixture: ASTM C260/C260M
 - 2. Water-Reducing Admixture: ASTM C494/C494M, Type A
 - 3. Retarding Admixture: ASTM C494/C494M, Type B
 - 4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D
 - 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F

6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G
7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II

2.5 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for the following items shall be designated as follows:
 1. Curbs, Gutters, and Sidewalks: Minor concrete.
 2. Cast in Place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.
 3. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
 4. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of portland cement per cubic yard of concrete.
 5. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.

2.6 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless specified otherwise herein or on the Plans, expansion joint thickness shall be as follows:
 1. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½ inch
 2. Structures: As indicated

2.7 REINFORCEMENT AND DOWELS

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM A615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.
- B. Slip dowels, where noted or called for on the Plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM A1064. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM A1064.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.8 CURING AND SEALING MATERIALS

A. Curing Compounds:

1. Concrete surface repellent-vertical and/or flatwork: Repello surface treatment, invisible chemical treatment barrier system.

2.9 FORMS

A. Conform to the requirements of Section 73-1.03C and Section 90-1.03B(5) of the Caltrans Standard Specifications.

B. Tolerance: Not to deviate more than ¼ inch in 10 feet in grade and alignment.

2.10 PRECAST CONCRETE STRUCTURES

A. Conform to the following Sections of Caltrans Standard Specifications:

1. 51-7, Minor Structures
2. 70-5.02, Flared End Sections

2.11 CONCRETE VEHICULAR PAVEMENT

A. General: See Section 32 13 13, Concrete Pavement.

PART 3 EXECUTION

3.1 STRUCTURAL EXCAVATION

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density as determined by ASTM D1557.
- C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

3.2 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Consulting Engineer for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or

structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.

- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.3 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.4 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4 inches.
 - 2. Surfaces poured against earth: 3 inches.
 - 3. Formed surfaces exposed to earth or weather: 2 inches.
 - 4. Slabs, walls, not exposed to weather or earth: 1 inch.
- D. Minimum spacing, center of parallel bars shall be two and one half ($2 \frac{1}{2}$) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to

pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.5 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

- A. Transit mix concrete in accordance with the requirements of ASTM Designation C94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner's Representative.
- B. Do not hand mix concrete for use in concrete structures.

3.6 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 PLACING ACCESSORY MATERIALS

- A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with Section 51-2.04 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.
- B. Curing Compounds:
 - 1. Regular Portland Cement Concrete: 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.

3.8 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.

- C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.
- D. Leave edge forms in place at least 24 hours after pouring.

3.9 FIELD QUALITY CONTROL

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.
- B. No concrete shall be placed prior to approval of forms.
- C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Conform the finish grade and cross section of concrete improvements to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances ACI 117 and as follows:
 - 1. Elevation: $\frac{1}{4}$ inch.
 - 2. Thickness: Plus $\frac{3}{8}$ inch, minus $\frac{1}{4}$ inch.
 - 3. Surface: Gap below 10 foot long, unleveled straightedge not to exceed $\frac{1}{4}$ inch.
 - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 - 5. Vertical Alignment of Tie Bars and Dowels: $\frac{1}{4}$ inch.
 - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: $\frac{1}{2}$ inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel $\frac{1}{4}$ inch per 12 inches.
 - 8. Joint Spacing: 3 inches, unless otherwise indicated.
 - 9. Contraction Joint Depth: Plus $\frac{1}{4}$ inch, no minus.
 - 10. Joint Width: Plus $\frac{1}{8}$ inch, no minus.

3.10 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 13 75

CONCRETE CURBS AND GUTTERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Portland cement concrete curbs and gutters, sidewalk, curb ramps and driveways.

1.2 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 11 00, Pavement Base Course
- C. Section 32 13 13, Concrete Pavement
- D. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: [Insert Report Name, Company and Date].
- B. American society for Testing and Materials (ASTM)
 - 1. A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 2. D1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- C. Caltrans Standard Specifications, 2015
 - 1. Section 51: Concrete Structures
 - 2. Section 72: Slope Protection
 - 3. Section 73: Concrete Curbs and Sidewalks
 - 4. Section 90: Concrete

1.4 DEFINITIONS

- A. ASTM: American Society for Testing Materials
- B. ACI: American Concrete Institute

1.5 SUBMITTALS

- A. Submittal procedures shall be as outlined in Section 01 10 00 – Supplemental General Requirements.
- B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Owner. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.6 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
- B. Certifications:
 - 1. Provide Owner at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
 - 2. Settlement of type and amount of any admixtures.
 - 3. Provide Owner, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.
- C. Conform to the applicable provisions of Sections 51, 73 and 90 of the Caltrans Standard Specification and these Technical Specifications.
 - 1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of Section 73 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
 - 2. Construct "V" ditches in accordance with Section 72-5 of the Caltrans Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73, or as otherwise required in these Technical Specifications or shown on the Plans.

1.7 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall be considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.
- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 PRODUCTS

2.1 GENERAL

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.2 PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for items in this section shall be Minor Concrete as specified in Section 90-2 of the Caltrans Standard Specifications.
- B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:
 - 1. Compressive Strength:
 - a. Typical: 3000 psi, minimum at 28 days, unless otherwise indicated.
 - b. Curbs & Gutters: 3500 psi, minimum at 28 days.
 - 2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer, limited to flatwork only); 4 inches for other concrete.
 - 3. Water/Cement Ratio: 0.5

2.3 CURBS AND GUTTERS FORMS

- A. Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

2.4 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.
- B. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
 - 1. Curbs, Curb Ramps, Island Paving, Driveways and Gutter Depressions: 1/4 inch

2.5 REINFORCEMENT AND DOWELS

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.
- B. Form, place and finish concrete curbs, gutters, walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.
- C. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12 inches of the asphalt concrete to allow placement

of curb or gutter forms. Patch pavement with a 6 inch deep lift of asphalt concrete after gutter form is removed.

3.2 SUBGRADE

- A. Conform to Section 73-1.03B of Caltrans Standard Specifications.

3.3 SOIL STERILANT

- A. Furnish and apply an oxidation granular preemergent soil sterilant to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.

3.4 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.5 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4 inches
 - 2. Surfaces poured against earth: 3 inches

- 3. Formed surfaces exposed to earth or weather: 2 inches
- 4. Slabs, walls, not exposed to weather or earth: 1 inch
- D. Minimum spacing, center of parallel bars shall be two and one half ($2 \frac{1}{2}$) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.6 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.7 EXPANSION JOINTS

- A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch smooth slip dowels in the positions shown or noted on the detail drawings.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.8 WEAKENED PLANE JOINTS

- A. Construct weakened plane joints in concrete curbs, gutters, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.
- C. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of $\frac{1}{8}$ inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.9 FINISHING CONCRETE

- A. Finish curb and gutter in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.

- B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.
- C. Provide a broom finish to all horizontal surfaces perpendicular to the path of travel on surfaces used by pedestrians:
 - 1. Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.
 - 2. Surfaces Sloped Greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.10 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave edge forms in place at least 24 hours after pouring.

3.11 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

- A. New curb or gutter is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½ inch diameter by 12 inch long dowels at 24 inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.
- B. A cold joint to the existing curb is not acceptable.

3.12 FIELD QUALITY CONTROL

- A. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.
- B. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Section 73 of the Caltrans Standard Specifications.

3.13 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 14 00

UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete pavers.

B. Related Requirements:

1. Section 32 13 13 "Concrete Paving" for concrete base under unit pavers.
2. Section 32 14 43 "Porous Unit Paving" for unit paving using grid pavers or pavers with openings between them.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For materials other than water and aggregates.
2. For the following:
 - a. Pavers.
 - b. Bituminous setting materials.
 - c. Mortar and grout materials.
 - d. Edge restraints.

- B. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C136.

C. Samples for Initial Selection: For each type of unit paver indicated and the following:

1. Joint materials involving color selection.
2. Exposed edge restraints involving color selection.

D. Samples for Verification: For full-size units of each type of unit paver indicated. Include Samples of the following:

1. Joint materials.
2. Exposed edge restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

- B. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

C. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

- D. Installer Qualifications: A qualified unit paving installer. Installer's field supervisor must have

Concrete Paver Installer Certification from the Interlocking Concrete Pavement Institute (ICPI) with one of the following designations:

1. Commercial Paver Technician Designation.

E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store asphalt cement and other bituminous materials in tightly closed containers.

1.6 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Bituminous Setting Bed:

1. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry.

2. Apply asphalt adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 CONCRETE PAVERS

- A. Concrete Pavers, Solid Paving Units: Complying with ASTM C936/C936M and resistant to freezing and thawing when tested according to ASTM C67, made from normal-weight aggregates.
 - 1. Thickness: 2-3/8 inches.
 - 2. Face Size and Shape: per plans.
 - 3. Color: per plans.

2.3 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Subbase: Sound, crushed stone or gravel complying with ASTM D448 for Size No. 57.
- B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C33/C33M for fine aggregate.
- C. Stone Screenings for Leveling Course: Sound stone screenings complying with ASTM D448 for Size No. 10.
- D. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.
 - 1. Provide sand of color needed to produce required joint color.
- E. 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. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.
 - 3. Permittivity: 0.02 per second, minimum; ASTM D4491.
 - 4. UV Stability: 50 percent after 500 hours' exposure, ASTM D4355.
- F. Drainage Geotextile: Nonwoven needle-punched geotextile fabric, 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. Apparent Opening Size: No. 40 sieve, maximum; ASTM D4751.
 - 3. Permittivity: 0.5 per second, minimum; ASTM D4491.
 - 4. UV Stability: 50 percent after 500 hours' exposure, ASTM D4355.
- G. Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

2.4 BITUMINOUS SETTING-BED MATERIALS

- A. Primer for Base: ASTM D2028/D2028M, cutback asphalt, grade as recommended by unit paver manufacturer.
- B. Fine Aggregate for Setting Bed: ASTM D1073, No. 2 or No. 3.
- C. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

1. Provide sand of color needed to produce required joint color.

2.5 BITUMINOUS SETTING-BED MIX

- A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate unless otherwise indicated. Heat mixture to 300 deg F.

2.6 MORTAR AND GROUT MIXES

- A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimal performance characteristics. Discard mortars and grout if they have reached their initial set before being used.
- B. Mortar-Bed Bond Coat: Mix neat cement and water to a creamy consistency.
- C. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C270, Proportion Specification.
- D. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.
- E. Thinset Mortar Bond Coat: Proportion and mix according to manufacturer's written instructions.
- F. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture.
 1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.
 2. Colored-Aggregate Grout: Produce color required by combining colored aggregates with portland cement of selected color.
- G. Packaged Grout: Proportion and mix according to grout manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Where unit paving is to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove substances from concrete substrates that could impair mortar bond, including

curing and sealing compounds, form oil, and laitance.

- B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
 - 1. For concrete pavers, a block splitter may be used.
- D. Handle protective-coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. If, despite these precautions, coating does contact bonding surfaces of brick, remove coating from bonding surfaces before setting brick.
- E. Joint Pattern: per plan.
- F. Tolerances:
 - 1. Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) or 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.
 - 2. Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- G. Expansion and Control Joints:
 - 1. Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete. Install joint filler before setting pavers. Sealant materials and installation are specified in Section 07 92 00 "Joint Sealants."
 - 2. Provide cork joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.
- H. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 - 1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
 - 2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.
 - 3. Install job-built concrete edge restraints to comply with requirements in Section 03 30 00 Cast-in-Place Concrete and 32 13 13 Concrete Paving.
 - 4. Where pavers set in mortar bed are indicated as edge restraints for pavers set in aggregate setting bed, install pavers set in mortar and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.
 - 5. Where pavers embedded in concrete are indicated as edge restraints for pavers set in aggregate setting bed, install pavers embedded in concrete and allow concrete to cure before placing aggregate setting bed and remainder of pavers. Hold top of concrete below aggregate setting bed.

- I. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.
 1. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

3.4 AGGREGATE SETTING-BED APPLICATIONS

- A. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.
- B. Place aggregate subbase and base, compact by tamping with plate vibrator, and screed to depth indicated.
- C. Place aggregate subbase and base, compact to 100 percent of ASTM D1557 maximum laboratory density, and screed to depth indicated.
- D. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches.
- E. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- F. Treat leveling course with herbicide to inhibit growth of grass and weeds.
- G. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers.
 1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
- H. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
 2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
 3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
 4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
- I. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
- J. Do not allow traffic on installed pavers until sand has been vibrated into joints.

- K. Repeat joint-filling process 30 days later.

3.5 BITUMINOUS SETTING-BED APPLICATIONS

- A. Apply primer to concrete slab or binder course immediately before placing setting bed.
- B. Prepare for setting-bed placement by locating 3/4-inch-deep control bars approximately 11 feet apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated.
- C. Place bituminous setting bed where indicated, in panels, by spreading bituminous material between control bars. Spread mix at a minimum temperature of 250 deg F. Strike setting bed smooth, firm, even, and not less than 3/4 inch thick. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill depressions that remain after removing depth-control bars.
 - 1. Roll setting bed with power roller to a nominal depth of 3/4 inch. Adjust thickness as necessary to allow accurate setting of unit pavers to finished grades indicated. Complete rolling before mix temperature cools to 185 deg F.
- D. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.
- E. Joint Treatment: Place unit pavers with hand-tight joints. Fill joints by sweeping sand over paved surface until joints are filled. Remove excess sand after joints are filled.

3.6 MORTAR SETTING-BED APPLICATIONS

- A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
- B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Do not exceed 1/16-inch thickness for bond coat. Limit area of bond coat to avoid its drying out before placing setting bed.
- C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
- D. Place reinforcing wire over concrete subbase, lapped at joints by at least one full mesh and supported so mesh becomes embedded in the middle of mortar bed. Hold edges back from vertical surfaces approximately 1/2 inch.
- E. Place mortar bed with reinforcing wire fully embedded in middle of mortar bed. Spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
- F. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

- G. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch-thick bond coat to mortar bed or to back of each paver with a flat trowel.
- H. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
- I. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/8 inch.
- J. Grouted Joints: Grout paver joints complying with ANSI A108.10.
- K. Grout joints as soon as possible after initial set of setting bed.
 - 1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
 - 2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
 - 3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 - 4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.
- L. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.7 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.
- C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
 - 1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
 - 2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION

SECTION 32 15 40
STABILIZED CRUSHED AGGREGATE PAVING

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 Section Includes

- A. Section Includes: Supply and installation of stabilized crushed aggregate paving as indicated in the Contract documents, including:

- 1. Base Course
- 2. Crushed Aggregate Paving
- 3. Organic Binder for Crushed Aggregate

1.3 References

- A. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates.
- B. ASTM D2419 – Sand Equivalent Value of Soils and Fine Aggregates.

1.4 Submittals

- A. Submit in accordance with Section 01 33 0001330 - Submittal Procedures:
 - 1. Manufacturer's product data sheet.
 - 2. 1 quart sample of base course.
 - 3. Base Course gradation indicating that the product meets specifications.
 - 4. 1 quart sample of stabilized crushed aggregate paving.
 - 5. Stabilized crushed aggregate gradation indicating that the product meets specifications.

1.5 Mock-Up

- A. Install 20 square feet minimum of stabilized crushed aggregate paving including base course, at location approved by Architect.
- B. Allow Architect to view mock-up before proceeding with rest of stabilized crushed aggregate paving.
- C. Approved mock-up may remain as part of completed Work.

1.6 Delivery, Storage and Handling

- A. Protect stabilized crushed aggregate mix from contamination. Store under cover.

1.7 Sequencing

- A. Do not install work specified in this Section prior to acceptance of earth moving.
- B. Coordinate work specified in this Section with work specified in other Sections to minimize cutting of and operation of heavy equipment over installed stabilized crushed aggregate paving.

- C. Do not install stabilized crushed aggregate surfacing when subbase is wet at saturated field capacity.

PART 2 - PRODUCTS

2.1 Materials

- A. Base Course Materials:
- B. Comply with MTO OPSS 1010 – “Material Specification for Aggregates – Granular A, B, M and Select Subgrade Material” specification for Granular A material.
- C. Crushed Aggregate Materials:
 - 1. Crushed Aggregate Material shall consist of sound, angular, durable particles.
 - 2. Gradation, in accordance with ASTM C136:
- D. Aggregate color shall be selected from a pre-approved material pallet from Gail Materials 951-667-6106, www.gailmaterials.net.
- E. Organic Binder:
 - 1. Organic-Lock self-healing organic binder by Gail Materials, Corona, CA; phone 951-667-6106; fax 951-667-6102; www.gailmaterials.net.
 - 2. Requests for substitutions will be considered in accordance with provisions of section 01 25 00 Substitution Procedures.
 - 3. Substitutions: Not permitted.
 - 4. Mix Crushed Aggregate Material with Organic-Lock™ binder using a pug mill that includes a weigh-belt feeder.
 - 5. Mix rate of Organic-Lock depends on the selected material as well as the application and shall be determined by Gail Materials.
- F. Accessories:
 - 1. Water: Free from contaminants that would discolor or be deleterious to stabilized aggregate paving.

PART 3 - EXECUTION

3.1 Examination

- A. Examine grading and subsoil conditions. Do not proceed until conditions are acceptable.

3.2 Preparation of Subgrade

- A. Excavate to depth required so that finish grade can be established as noted on plans.
- B. Remove excavated soil from site. Spread excavated surface as specified in Section 31 10 00
- C. Compact subgrade to 95% Modified Proctor Density.
- D. Excavate soft and unstable areas of subgrade that cannot be compacted to standard noted, fill and compact with approved granular material.

3.3 Base Course

- A. Place base course material over subgrade to depths and dimensions shown on drawings in maximum (6") lifts compacted to 95% Modified Proctor Density.

3.4 Pre-BLENDED ORGANIC Lock Aggregate Surfacing

- A. For typical pathways or trails install Organic Lock Aggregate Paving to a compacted depth of 4 inches. For areas of vehicular use or equal install Organic Lock Aggregate Paving to a compacted depth of 6 inches.
- B. Prewetted Organic Lock Aggregate Paving can be installed in one lift for pathway, trails or equal application. For areas of vehicular use of compacted depths of 6 inches or greater shall be installed at 3-inch compacted lifts. Estimated compacted max density is +/- 129 lbs/cu. ft. The moisture percentage in the prewetted Organic Lock Aggregate Paving will be determined by Gail Materials and will depend on selected aggregate.
- C. For applications that are not prewetted by Gail Materials the Organic Lock Aggregate Paving will be delivered dry. Gail Materials will calculate the required gallons of water to be added per ton of selected material in order to reach the ideal moisture percentage for installation. In order to ensure that water is being applied correctly the Organic Lock Aggregate Paving shall be bucket blended or equal prior to spreading. Gail Materials does not recommend installing Organic Lock Aggregate Paving in place and then watering in either lifts or from the surface down.
- D. Depending on weather conditions, the time required to allow the material to set-up before it can be compacted varies. Generally, this time period is between 6 and 48 hours. The top layer should be firm and not sticky. Compaction can begin when you can walk on the material without significantly sinking in and material does not feel muddy. If material sticks to the roller during compaction, allow the material to further dry. Do not allow the material to completely dry out.
- E. Make 4-6 passes using a 1-10 ton double or single static drum roller, or equivalent. Do not use a vibratory compactor or vibratory setting on the compactor. The contractor shall select the proper size roller for the appropriate application.
- F. After final compaction, the surface shall be true to elevation and shall not vary by more than (1/4") tested with a straight edge at any location on the surfaces. Surfaces can either be crowned at a minimum of 2% and/or installed with a cross slope of minimum 1%.
- G. Compaction testing shall not be conducted until the Organic Lock Aggregate Paving has been allowed to thoroughly dry and cure.

3.5 Adjust and Clean

- A. All paved areas or adjacent surface shall be brushed clean and excess materials shall be removed from the work site and disposed of in an approved dump location.

3.6 Protection

- A. Do not allow traffic on stabilized crushed aggregate paving after placement or until compacted stabilized crushed aggregate paving has fully cured. This time may vary depending on weather conditions.
- B. Protect stabilized crushed aggregate paving surface from damage until Project completion.

Repair damaged areas to match specified requirements.

3.7 Maintenance & Repairs

- A. Loose aggregate will appear on the surface over time and is a natural occurrence. If excess material becomes loose, redistribute the material over the surface, water thoroughly and re-compact with a minimum 1-ton drum roller.
- B. To repair, excavate damaged area and scarify exposed stabilized crushed aggregate paving. Pre-blend replacement crushed aggregate material with Organic-Lock™ Aggregate Paving at the specified rate. Apply material to the excavated area and compact. Thoroughly water the material and allow the material to cure, but not completely dry out. Re-compact the material, ensuring that the final grade and crown are maintained. Do not use a vibratory compactor.

END OF SECTION

SECTION 32 17 13

PARKING BUMPERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes concrete precast wheel stops.

1.2 RELATED SECTIONS

- A. Section 01 00 00, Supplemental General Requirements

1.3 SUBMITTALS

- A. Follow submittal procedure outlined in accordance with Section 01 10 00, Supplemental General Requirements.
- B. Submit product data for each type of product.

PART 2 PRODUCTS

2.1 PARKING BUMPERS

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 2500 psi minimum compressive strength, 5½ inches high by 7½ inches wide by 48 inches long (or length as shown on plans). Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed vertical holes through wheel stop for anchoring to substrate.
 - 1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
 - 2. Mounting Hardware: Galvanized-steel dowel, ½ inch diameter, 24 inch minimum length.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Oldcastle Precast
 - 2. Bertelson Precast
 - 3. Barco Products, or approved equal

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Removal of existing traffic stripes and pavement markers
- B. Removal of existing signs
- C. Cleaning and sweeping of streets before application of traffic stripes and pavement markings
- D. Materials and application for traffic stripes and pavement markings
- E. Materials and application for pavement markers
- F. Traffic control signs and street name signs
- G. Object markers
- H. Survey monuments

1.2 RELATED SECTIONS

- A. Section 01 10 00, Supplemental General Requirements
- B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

- A. Caltrans Standard Specifications, 2015
 - 1. Section 78, Incidental Construction
 - 2. Section 81, Miscellaneous Traffic Control Devices
 - 3. Section 82, Signs and Markers
 - 4. Section 84, Markings
- B. Caltrans Standard Plans, 2015
 - 1. Plan A20A through A20D: Pavement Markers and Traffic Lines, Typical Details
 - 2. Plan A24A and A24B: Pavement Markings Arrows
 - 3. Plan A24C: Pavement Markings, Symbols and Numerals
 - 4. Plan A24D: Pavement Markings, Words
 - 5. Plan A24E: Pavement Markings, Words, Limit and Yield Lines
 - 6. Plan A24F: Pavement Markings, Crosswalks
 - 7. Plan A73A: Object Markers
 - 8. Plan A73B: Markers
 - 9. Plan A73C: Delineators, Channelizers and Barricades

10. Plan A74: Survey Monuments

11. Plan RS1: Roadside Sign, Typical Installation Details No. 1

12. Plan RS2: Roadside Sign, Wood Post - Typical Installation Details No. 2

13. Plan RS3: Roadside Sign, Laminated Wood Box Post - Typical Installation Details No. 3

14. Plan RS4: Roadside Sign, Typical Installation Details No. 4

C. The State of California Traffic Manual, 2014

D. The regulations, standards, and tests of the State of California Department of Transportation Materials and Research Division, edition in effect at time of date on Plans.

E. Professional Land Surveyor's Act, Business and Professions Code §§ 8700 – 8805

1.4 SUBMITTALS

A. Submit product data for each of the following in accordance with Section 01 10 00, Supplemental General Requirements:

1. Traffic paint
2. Pavement markers and adhesives
3. Reflectorized markers and posts

1.5 QUALITY ASSURANCE

A. Deliver certificates showing conformance with this specification to the Owners Representative with each shipment of materials and equipment to the Project site.

B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

1.6 PROJECT CONDITIONS

A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the Owners Representative.

B. Thoroughly cure new asphalt concrete and portland cement concrete before application of stripes, markings or markers.

PART 2 PRODUCTS

2.1 THERMOPLASTIC STRIPES AND MARKING

A. Thermoplastic striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02B, unless noted otherwise herein or on the Plans.

B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

C. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

2.2 PAINTED STRIPES AND MARKINGS

- A. Painted striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02C, unless noted otherwise herein or on the Plans.
- B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

2.3 PAVEMENT MARKERS

- A. Pavement Markers shall be in accordance with Caltrans Standard Specification Section 81-3, Pavement Markers, and as indicated on the Plans.
- B. Material
 - 1. Non-reflective Material shall be in accordance with Caltrans Standard Specification Section 81-3.02B, Non-Reflective Pavement Markers.
 - 2. Retroreflective Material shall be in accordance with Caltrans Standard Specification Section 81-3.02C, Retroreflective Pavement Markers.
- C. Adhesive:
 - 1. Adhesive Material shall be in accordance with Caltrans Standard Specification Section 81-3.02D, Hot Melt Bituminous Adhesive.

2.4 TRAFFIC CONTROL SIGN

- A. General: Traffic control signs shall be in accordance with Caltrans Standard Specification Section 82-1, Signs and Markers.
- B. Sign Panels shall be in accordance with Caltrans Standard Specification Section 82-2, Sign Panels. Conform type (regulatory or warning), size, shape and pattern to the State of California, Department of Transportation, Traffic Manual, edition in effect at the date of the Plans.
- C. Posts:
 - 1. Metal Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02B, Metal Posts.
 - 2. Wood Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02C, Wood Posts.
- D. Mounting Hardware shall be in accordance with Caltrans Standard Specification 82-3.02E, Sign Panel Fastening and Mounting Hardware, unless otherwise specified.
- E. Post Foundations: Conform to Caltrans Standard Plans.

2.5 STREET NAME SIGNS

- A. Conform to manufacturer, style, size, and shape shown on the Plans.
- B. Posts: 2 inch inside diameter steel pipe unless noted otherwise on the Plans. Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02B, Metal Posts.
- C. Post Foundations: Portland cement concrete in accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.6 REFLECTORIZED OBJECT MARKERS

- A. ReflectORIZED Metal Object Markers: In accordance with Caltrans Standard Specification Section 82-5, Markers, for target plates and reflectors, and Caltrans Standard Plans A73A through A73C. Marker type shall be as shown on Plans.
- B. Posts: Metal posts shall be in accordance with Caltrans Standard Specification Section 82-5.02C, Metal Posts, and Caltrans Standard Plan A73B.
- C. Mounting Hardware: In accordance with Caltrans Standard Specification Section 82-5.02G, Hardware.

2.7 STREET SURVEY MONUMENTS

- A. General: In accordance with Caltrans Standard Specification Section 78-2, Survey Monuments, except that the marker disk will not be furnished. Marker disk shall be 2 inch diameter solid brass with a 2 3/4 inch shaft, "Lietz No. 525" or approved equal.
 - 1. Portland Cement Concrete: In accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 EXECUTION

3.1 REMOVAL OF TRAFFIC STRIPES, PAVEMENT MARKINGS AND PAVEMENT MARKERS

- A. Where blast cleaning is used for the removal of painted traffic stripes and pavement markings, or for removal of objectionable material, remove the residue, including dust and water, immediately after contact with the surface being treated. Remove by a vacuum attachment operating concurrently with the blast cleaning operation.
- B. Where grinding is used for the removal of thermoplastic traffic stripes and pavement markings; remove the residue by means of a vacuum attachment to the grinding machine. Do not allow the residue to flow across or be left on, the pavement.
- C. Where markings are to be removed by blast cleaning or by grinding, the removed area shall be approximately rectangular so that no imprint of the removed marking remains on the pavement.
- D. Waste from removal of yellow painted traffic stripe may contain lead chromate. Residue produced when yellow paint is removed may contain heavy metals in concentrations that exceed thresholds established by the California Health and Safety Code and may produce toxic fumes when heated. As such, when grinding or other methods approved by the Owner's Representative are used to remove yellow painted traffic stripes, the removed residue, including dust, shall be collected and contained immediately. The Contractor shall submit a written work plan for the removal, storage, and disposal of yellow painted traffic stripe to the Owner's Representative for approval not less than fifteen (15) days prior to the start of the removal operations. Removal operations shall not be started until the Owner's Representative has approved the work plan.
- E. Contractor will be responsible for repairing any damage to the pavement during removal of pavement markers. Damage to the pavement, resulting from removal of pavement markers, shall be considered as any depression more than 1/4-inch deep.

3.2 TEMPORARY PAVEMENT MARKERS

- A. If permanent pavement markers cannot be installed immediately, and the street or road is to be placed in service, install short term, temporary pavement markers on the new pavement prior to opening the street or road to traffic.
- B. Place markers, at a minimum, of 24 feet on centers, or as required by the governmental agency having jurisdiction, in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways.

3.3 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements Caltrans Standard Specification Section 84-2.03, Construction, and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.4 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Caltrans Standard Specification Section 84-3.03, 3.04 and 3.05 and Caltrans Standard Plans A20A through A20D, and A24A through A24F.

3.5 PAVEMENT MARKERS

- A. Place in accordance with Caltrans Standard Specification Section 81-3.03, Construction.
- B. Pavement recesses are not required. Markers shall be installed accurately to the line established by the Owner's Representative. No markers shall be installed until the surface has been approved by the Owner's Representative.

3.6 TRAFFIC CONTROL SIGNS

- A. Install in accordance with Caltrans Standard Specification Sections 82-2.03 and 82-3.03, Caltrans Standard Plan RS1, the applicable requirements of the State of California Department of Transportation Maintenance Manual and the details shown on the Plans. The horizontal locations shown on Caltrans Standard Plan RS1 shall not be applicable, the horizontal location shall be as shown on the Plans.
- B. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.
- C. After erection, damage to traffic sign faces shall be touched up or the sign replaced.

3.7 STREET NAME SIGNS

- A. Install in accordance with the manufacturer's instructions and as shown on the Plans.
- B. Horizontal location shall be as shown on the Plans.
- C. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

3.8 REFLECTORIZED OBJECT MARKERS.

- A. Install in accordance with Caltrans Standard Specification Section 82-5.03, Construction, except that the metal marker posts shall not be driven in place without prior approval of the Owner's Representative.

- B. Install at locations shown on the Plans.

3.9 STREET SURVEY MONUMENTS

- A. Install Survey Monuments in accordance with Caltrans Standard Specification Section 78-2.03, Construction and Caltrans Standard Plan A74, except that the marker disk will not be furnished. Exact point in marker to be determined by an accurate survey and placed by a California Licensed Land Surveyors in accordance with the Professional Land Surveyors' Act.

3.10 PROTECTION

- A. Protect the newly installed traffic stripes and pavement markings from damage until the material has cured.
- B. Replace any traffic stripes or pavement markings or markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

3.11 RESTORATION OF EXISTING IMPROVEMENTS

- A. Existing signs striping or other markings removed or damaged due to the installation of new facilities shall be replaced in kind.
- B. Existing landscaping or planting removed, damaged or disturbed due to the installation of traffic control signs or street name signs shall be replaced in kind.

END OF SECTION

SECTION 32 17 26
TACTILE WARNING SURFACING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Embedded tactile warning surface tile, with an inline dome pattern, for application on ramps and level walking surfaces.
- B. Tactile Tile Installation Method: As indicated on Drawings, and as follows:
 - 1. New Concrete: Installation in cast-in-place uncured (wet) concrete.

1.2 RELATED SECTIONS

- A. Section 03 30 00 – Cast-in-Place Concrete.

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. AASHTO HB-17 – Standard Specifications for Highway Bridges.
 - 2. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - 3. ASTM C293 – Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading).
 - 4. ASTM C1028 – Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 - 5. ASTM D543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
 - 6. ASTM D570 – Standard Test Method for Water Absorption of Plastics.
 - 7. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
 - 8. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics.
 - 9. ASTM D1037 – Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
 - 10. ASTM D2486 – Standard Test Methods for Scrub Resistance of Wall Paints.
 - 11. ASTM D5420 – Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).

- 12. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- 13. ASTM G155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Materials.
- 14. SAE AMS-STD-595A – Color Used in Government Procurement.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings: Show detailed plans of tile profile and installation methods.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm specializing in manufacturing products specified in this Section with a minimum five years' experience.
- B. Asphalt Pavement Substrate: Installation of tiles directly over asphalt pavement is not permitted. Where tactile warning system extends into asphalt pavement, the following procedures shall apply:
 - 1. Asphalt Pavement Procedures: Remove existing asphalt pavement to base course; clean and re-compact existing base course; place new concrete pad over base course; install Cast-in-Place Type tiles over uncured (wet) concrete substrate as specified in this Section.

1.6 REGULATORY REQUIREMENTS

- A. Provide detectable (tactile) warning products in accordance with California Code of Regulations (CCR). Title 24, Part 1, 2025 California Administrative Code, Chapter 5 "Access to Public Buildings by Persons with Disabilities".
 - 1. Article 2 "Division of the State Architect – Access Compliance Processing Product Approvals".
 - 2. Article 3 "Acceptance of Detectable Warning and Directional Surface Products for Manufacturers and Design Professionals".
- B. Definition of Detectable Warning: Conform to 2025 California Building Code, Chapter 2 "Definitions", Section 202, "Definitions".
 - 1. Chapter 11B "Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing," Section 11B-106.5 "Defined Terms" for detectable warning.
- C. Detectable Warnings for Site Accessibility: Provide detectable warning system in accordance with 2025 California Building Code, Chapter 11B, "Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing", Section 11B-705.1, Section 11B-705.1.1.4, and the following:
 - 1. Detectable Warnings at Curb Ramps: Chapter 11B, Section 11B-206 "Accessible Routes", Section 11B-406.5.12, "Detectable Warnings", and Section 11B-705.1.2.2, "Curb Ramps".
 - 2. Detectable Warnings at Hazardous Vehicular Areas: Chapter 11B, Section 11B-206, "Accessible Routes", Section 11B-406.5.12, "Detectable Warnings", and Section 11B-705.1.2.5, "Hazardous Vehicular Areas".

3. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact per Section 11B-705.1.1.4.
4. Dome size and spacing shall comply with Chapter 11B, Section 11B-705.1.1.1 and Section 11B-705.1.1.2.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle packaged products in original containers with seals unbroken and labels intact until the time of installation.
- B. Store delivered products in a clean, safe, dry area.

1.8 WARRANTY

- A. Five years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Armor-Tile, Elgin, IL; 844-697-2920, www.armor-tile.com. Products:
 1. Cast-in-Place Type Armor-Tile for embedding in cast-in-place uncured (wet) concrete.
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Tactile Warning Tiles: An epoxy polymer composite with an ultraviolet stabilized coating containing aluminum oxide particles in the truncated domes.
 1. Cast-in-Place Type Tile for Embedding in Cast-in-Place Uncured (Wet) Concrete:
 - a. Tile thickness to be 0.3875 inch at domes and 0.1875 inch in flat areas between domes. Total thickness at perimeter to be 1.375 inches; dome height to be 0.20 inch.
 - b. Tile underside to have embedment flanges with 0.625-inch diameter holes; long sides to have 0.1875-inch diameter vent holes.
 - c. Tile to have sound amplifying plastic plates attached between flanges, with an air space between tile bottom surface and sound amplifying plastic plates.
 - d. Tile face to have non-slip texture.
- B. Color and Size:
 1. Safety Yellow, (Color: AMS-STD 33538 of SAE AMS-STD-595A) colorfast, UV stabilized coating. Color shall be uniform throughout the tile.
 2. Sizes: As indicated on Drawings.
- C. Performance Requirements: Tactile warning tiles shall meet or exceed the following criteria:
 1. Water Absorption: 0.05 percent, maximum, when tested in accordance with ASTM D570.
 2. Slip Resistance: 0.80, minimum combined wet/dry static coefficient of friction on top of domes and field area, when tested in accordance with ASTM C1028.
 3. Compressive Strength: 28,000 psi, minimum, when tested in accordance with ASTM D695.

4. Tensile Strength: 19,000 psi, minimum, when tested in accordance with ASTM D638.
5. Flexural Strength: 25,000 psi, minimum, when tested in accordance with ASTM C293.
6. Gardner Impact: 550 inch-pounds per inch minimum, when tested in accordance with ASTM D5420.
7. Chemical Stain Resistance: No discoloration or staining when exposed to 10 percent hydrochloric acid, urine, saturated calcium chloride, black stamp pad ink, chewing gum, red aerosol paint, 10 percent ammonium hydroxide, 1 percent soap solution, turpentine, 5 percent Urea, diesel fuel, motor oil, and tested in accordance with ASTM D543.
8. Wear Depth: 0.06 inch, maximum, after 1000 abrasion cycles of 40 grit Norton Metalite sandpaper (www.nortonabrasives.com), tested in accordance with ASTM D2486.
9. Flame Spread: 15 maximum, when tested in accordance with ASTM E84.
10. Accelerated Weathering: No deterioration, fading or chalking, when tested for 3,000 hours in accordance with ASTM G155.
11. Accelerated Aging and Freeze Thaw Test of Tile and Adhesive System: No cracking, delamination, warping, checking, blistering, color change, loosening of tiles, or other detrimental defects, when tested in accordance with ASTM D1037.
12. Salt and Spray Performance: No evidence of deterioration or defects after 200 hours of exposure, when tested in accordance with ASTM B117.
13. AASHTO HB-17 Single Wheel HS20-44 Loading Test for Cast-in-Place Type Tile: Mounted on concrete platform with 1/2 inch air space at the underside of tile and subjected to a maximum load of 10,400 pounds, corresponding to 8,000 pound individual wheel load and 30 percent impact factor; no visible damage at maximum loading.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install tactile warning surface tiles in accordance with Manufacturer's written installation instructions.
- B. Install Cast-in-Place Type tiles over cast-in-place, uncured (wet) concrete.
- C. Ensure that the surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation.
- D. Installation in Cast-in-Place Uncured (Wet) Concrete: Maintain concrete in 4 inch to 7 inch slump range. Lay tactile warning surface tiles (without removing protective plastic wrap) in uncured (wet) concrete and tamp each tile in place. Place weights over tiles to prevent floating, as recommended by the manufacturer. After curing, remove protective plastic wrap, and clean tile surfaces.
- E. Installation at Asphalt Pavement: Do not install tactile warning surface tiles directly over asphalt surfaces. Provide new concrete substrate for tile installation as follows:
 1. New Asphalt Pavement: In areas to be tiled, prepare base course for concrete placement. Protect area from asphalt work.
 2. Existing Asphalt Pavement: In areas to be tiled, cut out existing asphalt pavement to base course for concrete placement.

3. Substrate Preparation: Remove asphalt concrete to expose existing base course. Remove asphaltic debris, level and compact base course. Prepare base course for concrete placement, as indicated on Drawings and as acceptable to Architect. Concrete placement area shall be 2 inches to 3 inches larger than actual area to be tiled.
4. Install concrete pad over base course, as recommended by tile manufacturer.
5. Install Cast-in-Place Type tiles in uncured (wet) concrete as previously specified.
6. Install sealant at tile perimeter as recommended by tile manufacturer.
7. Place asphalt concrete after tiles are set and substrate material is completely cured. Asphalt may abut the tile edges or sealant at tile perimeter, as applicable.

END OF SECTION

SECTION 32 18 13
SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Synthetic grass surfacing.

B. Compliance

1. Synthetic turf products for play areas shall comply with ASTM F1951 for Wheelchair Accessibility and ASTM F1291 for Impact Attenuation.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Synthetic grass surfacing.

B. Shop Drawings: For synthetic grass surfacing.

1. Include sections and details.
2. Show locations of seams and method of seaming.
3. Show layout of game lines, numbers, and letters. Indicate application method of each line and marking.
4. Show location and layout of team logo/graphics.

C. Samples: For each type of synthetic grass surfacing indicated.

1. Turf Fabric: 12 inches square.
2. Infill Material: 4 oz. of each type.
3. Seam Sample: 24 inches square with seam centered in sample.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each synthetic grass surfacing assembly.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For synthetic grass surfacing, including maintenance cleaning instructions, to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Turf Fabric: Minimum of 300 sq. ft. for each type indicated.
2. Infill: Minimum of two bags of each type.
3. Seaming Tape and Adhesive: One roll of seaming tape and one gallon of adhesive.
4. One new set of maintenance tools, of type recommended by synthetic grass surfacing manufacturer for installation.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in location and manner to allow installation of synthetic grass surfacing without excess disturbance of granular base.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace synthetic grass surfacing that fails in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Deterioration and excessive wear.
 - b. Deterioration from UV light.
 - c. Seam separation, including game lines and markings.
 2. Warranty Period: 8 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Turf Fabric: Turf fabric tested in accordance with the following methods, with additional test method conditions for each method in accordance with ASTM F1551.
 1. Tuft Bind: Not less than 8 lbf in accordance with ASTM D1335.
 2. Breaking Strength: Minimum 200 lbf in warp direction and minimum 200 lbf perpendicular to warp direction, in accordance with ASTM D5034.

2.2 SYNTHETIC GRASS SURFACING

- A. Turf Fabric: Woven turf fabric with multicolored fiber and UV resistance, complying with the following:
 1. Yarn Fiber: Slit-film polyethylene Multifiber monofilament and slit-film polyethylene.
 2. Lead Content of Yarn Fiber: Maximum of 100 ppm in accordance with ASTM F2765.
- B. Backing: Manufacturer's standard woven or nonwoven polypropylene primary backing with urethane-coated secondary backing; provide perforations or drainage channels sufficient to meet permeability indicated.
- C. Infill: Manufacturer's standard sand and rubber infill.
 1. Infill Proportions: Manufacturer's standard proportions.

2.3 MATERIALS

- A. Rubber Infill: Ground SBR crumb rubber mesh free of metal, nonmetal fibers, and contaminants; mesh size as recommended by synthetic grass surfacing manufacturer.
- B. Sand Infill: Uniformly sized silica sand free of silts, clays, and contaminants, and of subangular or rounder shape in accordance with ASTM F1632; mesh size as recommended by synthetic grass surfacing manufacturer.
- C. Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches wide, 18 inches wide for inlaid game lines.
- D. Seaming Cord: Seaming cord or thread, recommended by the synthetic grass surfacing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine base and other conditions, with Installer present, for compliance with requirements for installation tolerances, permeability, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SYNTHETIC GRASS SURFACING

- A. Roll out turf fabric and allow to relax at least four hours prior to seaming.
- B. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.
- C. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.
- D. Evenly broadcast and groom infill by machine in proportions and depth after settling as recommended by the manufacturer, and to meet indicated performance requirements. Rake fibers trapped by infill to surface.

3.3 DEMONSTRATION

- A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION

SECTION 32 18 16.13
PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Unitary, seamless surfacing.

1.2 DEFINITIONS

- A. Definitions in ASTM F2223 apply to Work of this Section.
- B. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."
- C. SBR: Styrene-butadiene rubber.
- D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of protective surfacing.
1. Include plans, sections, placement and penetration details, and attachment to substrates.
 2. Include accessories and edge terminations.
 3. Include details of graphics.
 4. Include fall heights and use zones for equipment and structures specified in Section 11 68 00 "Play Field Equipment and Structures," coordinated with the critical heights for protective surfacing.
- C. Samples for Initial Selection: For each type of exposed finish.
1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of protective surfacing and exposed finish.
1. Include Samples of accessories to verify color and finish selection.
 2. Unitary, Seamless Surfacing: Minimum 6 by 6 inches.
 3. Unitary, Tile Surfacing: Minimum 6 by 6 inches.
 4. Loose-Fill Surfacing: Minimum 1 quart.
 5. Edging: 6 inches long by full width and cross section.
 6. Stabilizing Mats: Minimum 12 by 12 inches.
 7. Drainage/Separation Geotextile: Minimum 12 by 12 inches.
 8. Drainage Panel: Minimum 6 by 6 inches.
 9. Weed-Control Barrier: Minimum 12 by 12 inches.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of unitary surfacing product.
- C. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Unitary Tile Units: Full-size units equal to 1 percent of amount installed, but no fewer than 3 units.
 - 2. Loose Fill: Amount equal to 1 percent of amount installed, but no fewer than 3 units
 - 3. Edging Units: 3 full-size units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by the manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.
 - 1. Build mockups for protective surfacing including accessories.
 - a. Size: 48 inches by 48 inches.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.8 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Reduction in impact attenuation as measured by reduction of critical fall height.
 - b. Deterioration of protective surfacing and other materials beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain protective surfacing materials from single source from single manufacturer.
 - 1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.2 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: Critical fall height tested according to ASTM F1292.
- B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
- B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary, protective surfacing installation and that substrate surfaces are dry, cured, and uniformly sloped to drain within recommended tolerances according to protective surfacing manufacturer's written requirements for cross-section profile.
 - 1. Asphalt Substrates: Verify that substrates are dry, sufficiently cured to bond with adhesive, and free from surface defects, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond.
 - 2. Concrete Substrates: Verify that substrates are dry and free from surface defects, laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with protective surfacing or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by protective surfacing manufacturer.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.
- B. Hard-Surface Substrates: Clean surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with protective surfacing.
 - 1. Repair: Fill holes and depressions in unsatisfactory surfaces with leveling and patching material.
 - 2. Treatment: Mechanically abrade or otherwise prepare concrete substrates according to protective surfacing manufacturer's written instructions to achieve adequate roughness.
 - 3. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through protective surfacing.

3.3 INSTALLATION OF SEAMLESS SURFACING

- A. Mix and apply components of seamless surfacing according to manufacturer's written instructions to produce uniform, monolithic, and impact-attenuating protective surfacing of required overall thickness.
 - 1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading

- rate for type of substrate.
2. Poured Cushioning Layer: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
 3. Intercoat Primer: Over cured cushioning layer, apply primer at manufacturer's standard spreading rate.
 4. Wearing Layer: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
 - a. Design: Where colored pattern is required, place colored, design material as soon as previously placed material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.
 5. Edge Treatment: As indicated on Drawings. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with performance requirements.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Perform the following tests with the assistance of a factory-authorized service representative:
 1. Perform "Installed Surface Performance Test" according to ASTM F1292 for each protective surfacing type and thickness in each playground area.
 2. Perform installed-surface-performance tests at no less than one series of tests for each 1000 sq. ft. of each type and thickness of in-place protective surfacing or part thereof.
- C. Playground protective surfacing will be considered defective if it does not pass tests.
- D. Prepare test reports.

3.5 PROTECTION

- A. Prevent traffic over seamless surfacing for not less than 48 hours after installation.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Chain link fence framework, fabric, and accessories.
- B. Excavation and foundation for posts.
- C. Swinging gates and related hardware.

1.2 RELATED SECTIONS

- A. Section 08 71 00 – Door Hardware: Gate hardware.

1.3 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards and Manuals:
 - 1. ASTM A392 – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - 2. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 3. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 4. ASTM F567 – Standard Practice for Installation of Chain-Link Fence.
 - 5. ASTM F626 – Standard Specification for Fence Fittings.
 - 6. ASTM F668 – Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric.
 - 7. ASTM F900 – Standard Specification for Industrial and Commercial Steel Swing Gates.
 - 8. ASTM F1043 – Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
 - 9. ASTM F1664 – Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.
 - 10. CLFMI (Chain Link Fence Manufacturers Institute) Product Manual.
 - 11. UL 305 – Panic Hardware.

1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01.

- B. Product Data: Submit data on fabric, posts, accessories, fittings, and hardware.
- C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware, anchorage, gates, and schedule of components.

1.5 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: Firm specializing in manufacturing products specified in this Section with a minimum five years' experience.
 - 2. Installer Qualifications: Firm specializing in installation of products specified in this Section with a minimum five years' experience.
- B. Pre-Installation Meetings:
 - 1. Conduct pre-installation meeting in accordance with Division 01.
 - 2. Convene pre-installation meeting 1 week prior to commencing work of this Section.
 - 3. Coordinate work in this Section with work in related Sections.

1.6 REGULATORY REQUIREMENTS

- A. All accessible gates shall meet all applicable requirements for doors per CBC Chapter 11B, Sections 11B-206.5, and 11B-404.1.
- B. Hand-activated opening hardware, handles, pulls, latches, locks and other operating devices for accessible gates shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching or twisting of the wrist to operate per CBC Sections 11B-309.4 and 11B-404.2.7.
- C. The lever of lever actuated latches or locks for an accessible gate shall be curved with a return to within 1/2 inch of the face of gate per California Referenced Standards code, Title 24, Part 12, Section 12-10-202, Item (F).
- D. The bottom 10 inches of an accessible gate shall have a smooth, uninterrupted surface on each side extending the full width of the gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16 inch of the same plane as the other and shall be free of sharp or abrasive edges. Cavities created by added kickplates shall be capped. Bottom of the gates shall be within 3 inches of finish surface of the path of travel. Maximum effort to operate a gate shall not exceed 5 pounds per CBC Sections 11B-404.2.9 and 11B-404.2.10.
- E. Gate hardware installed at exterior locations subject to moisture or other weather-related elements shall be UL listed for all-weather use in wet locations and installation shall conform to 2025 CBC Section 1010.2.8, CCR Title 19, and UL 305.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Division 01.
- B. Packaging: Final gate assemblies shall be wrapped in protective material or crated to provide adequate protection during shipment.
- C. Storage and Protection: Store materials elevated from the ground and covered/protected from the weather, adequately ventilated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Master Halco, Inc., Dallas, TX; 800-883-8384, www.masterhalco.com.
- B. FenceScreen, LLC, Rancho Santa Margarita, CA; 888-750-6693, www.fencescreen.com.
- C. PrivacyLink, Smithfield, UT; 800-574-1076, eprivacylink.com.
- D. PEXCO, Atlanta, GA; 844-352-5777, www.pexco.com.
- E. Substitutions: Under provisions of Section 01 60 00.

2.2 MATERIALS

- A. Conform to CLFMI Product Manual.
- B. Framework:
 - 1. Round Pipe: Basis-of-Design: PT-40 by Master Halco, or accepted equal with the following properties:
 - a. Composition: ASTM A500 Grade B hot rolled steel with triple layer of corrosion resistance consisting of steel-adhered zinc bath, intermediate conversion coat, and clear vacuum-sealed top coat.
 - b. Yield Strength: 50,000 psi.
 - 2. Terminal Posts (End, Corner, and Angle Posts):
 - a. Fabric height 6 feet or less: 3.5 inch outside diameter.
 - 3. Intermediate Posts, Post Rail Braces, and Top and Bottom Rails:
 - a. Fabric height 6 feet or less: 2.375 inch outside diameter.
 - 4. Gate Posts:
 - a. Gate fabric height 6 feet or less:

Gate Leaf Width (foot)	Pipe Outside Diameter (inch)
Up to 4	2.375
Over 4 to 10	2.875
Over 10 to 18	4.000

- C. Fabric:
 - 1. ASTM A392; Class 2 zinc coating.
 - 2. 1 inch diamond mesh, No. 9 gauge wire.
 - 3. Top selvage knuckle/knuckle, bottom selvage knuckled end closed.
 - 4. Fabric shall have polyolefin coating as specified in this Section. Coating shall be applied to fabric wire prior to weaving of fabric.
- D. Tie-Wire: 9 gauge galvanized steel wire.
- E. Concrete: 3,000 pounds per square inch minimum compressive strength at 28 days, 3 inch to 4 inch slump; 1 inch nominal coarse aggregate.

2.3 ACCESSORIES

- A. General: Malleable steel, cast iron, or pressed steel conforming to ASTM F626; hot-dipped galvanized, minimum 2.0 ounces per square foot.
- B. Tension (Stretcher) Bars: One-piece lengths equal to full height of fabric with a minimum cross-section of 1/4 inch by 3/4 inch.
- C. Tension (Stretcher) Bar Bands: Steel, 3/4 inch x 1/10 inch nominal to secure tension bars to posts.
- D. Post Tops: Pressed steel, or malleable iron, designed as a weathertight closure cap for tubular post. Provide 1 cap for each exposed tubular post end.
- E. Truss Assembly: Capable of withstanding 2,000 pounds tension; consisting of minimum 3/8 inch diameter truss rod with truss tightener or turnbuckle.
- F. Boulevard Clamps: Two-piece clamp, minimum 12 gauge, with 5/16 inch carriage bolts and nuts.
- G. Braces: Same material as the rails extending from the terminal, corner, or pull post to the first adjacent intermediate post. Securely fasten braces to posts by heavy pressed steel and malleable fittings (minimum 12 gauge), then securely trussed from intermediate post to base of terminal post with a 3/8 inch truss rod equipped with a galvanized turnbuckle.
- H. Rail Ends: Weathertight closure for tubular rails and braces.

2.4 SWINGING GATES

- A. Fabricate chain link swing gates in accordance with ASTM F900.
- B. Gate frame shall be of welded construction. Weld areas to be protected with zinc-rich paint per ASTM A780.
- C. Gate frame members shall be spaced no greater than 8 feet – 0 inches apart horizontally or vertically.
- D. Exterior members shall be 1.900 inch OD pipe. Interior members when required shall be 1.660 inch OD pipe.
 - 1. Pipe shall be Grade 2 ASTM F1043 Group IC.
- E. Gate fabric to shall match fabric specified for fencing. Fabric shall be stretched tightly and secured to vertical outer frame members using tension bar and tension bands spaced 12 inches on center and tied to the horizontal and interior members at 12 inches on center using 9 gauge galvanized steel ties.
- F. Gate Hardware:
 - 1. Refer to Section 08 71 00.
 - 2. Provide metal fabrications to accept gate hardware as indicated on Drawings.

2.5 COATINGS

- A. Factory applied polyolefin coating.
- B. Color: Color as selected by Architect from manufacturer's standard colors.

C. Components:

1. Fabric: Thermally fused to zinc-coated wire conforming to ASTM F668; Class 2b.
2. Framework: Thermally fused to zinc-coated pipe conforming to ASTM F1043; 10 mils thick minimum.
3. Fittings: Thermally fused to zinc-coated fittings conforming to ASTM F626; 0.006 inch thick minimum.
4. Tie Wire: Thermally fused to zinc-coated wire conforming to ASTM F626.
5. Tension Wire: Thermally fused to zinc-coated wire conforming to ASTM F1664.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine conditions. Verify grade provides flat surface allowing fence construction with gap no more than 1-1/2 inch between bottom of bottom rail and the concrete mow strip.
- B. Report unacceptable conditions to the Architect. Begin installation only when unacceptable conditions have been corrected.

3.2 POST SPACING, HOLE DIAMETER, AND SETTING DEPTH

- A. Conform to ASTM F567.
- B. Space intermediate posts equidistant at intervals not exceeding 10 feet.
- C. Set terminal posts (end, corner, and gate) at the beginning of each continuous length of fence and at abrupt changes in vertical and horizontal alignments.
- D. Set fence and gate posts in concrete in holes of minimum diameter and depth as indicated on Drawings.

3.3 INSTALLATION

- A. Install in accordance with ASTM F567, Manufacturer's written installation instructions, and approved shop drawings.
- B. Install units plumb, level, and square, and free from warp or twist while maintaining dimensional tolerances and alignment with adjacent surfaces.
- C. Set intermediate, terminal, and gates posts plumb in concrete footings as indicated on the Drawings. Slope top of concrete as indicated on Drawings for water runoff.
- D. Brace each gate and corner post to adjacent intermediate post with horizontal center brace rail and diagonal truss rods. Install brace rail, 1 bay each side from terminal and gate posts.
- E. Provide top rail through intermediate post tops and splice with 6 inch long rail sleeves. Top rails shall be continuous, using 18 foot minimum lengths, except at corner and gate posts.
- F. Install center and bottom brace rail on corner gate leaves.
- G. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
- H. Position bottom of bottom rail 1-1/2 inches maximum above concrete mow strip.

- I. Fasten fabric to top rail, intermediate posts, braces, and bottom tension wire with tie wire at maximum 15 inch on centers.
- J. Attach fabric to terminal and gate posts with tension bars and tension bar clips.
- K. Install bottom tension wire stretched taut between terminal posts.
- L. Install tension wire anchor brackets to concrete and fence fabric at center point between posts.
- M. Do not swing gates from building wall; provide gate posts.
- N. Install gates with fabric to match fence. Install gate hardware as indicated in Section 08 71 00 and on Drawings.
- O. Touch-up areas of damaged coating with color-matching liquid touch-up after fence components have been installed.

3.4 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch.
- B. Maximum Offset from True Position: 1 inch.
- C. Components shall not infringe adjacent property lines.

3.5 ADJUSTING

- A. Adjust parts for smooth, uniform operation.
- B. Lubricate hardware and other moving parts.

END OF SECTION

SECTION 32 84 00
PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Encasement for piping.
3. Automatic drain valves.
4. Miscellaneous piping specialties.

B. Related Requirements:

1. Section 22 05 00 "Common Work Results for Plumbing" for water metering requirements.
2. Section 23 09 23.14 "Flow Instruments" for water metering equipment.

1.2 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
- C. ET Controllers: EvapoTranspiration Controllers. Irrigation controllers, which use some method of weather-based adjustment of irrigation. These adjusting methods include use of historical monthly averages of ET, broadcasting of ET measurements, or use of on-site sensors to track ET.
- D. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.3 ACTION SUBMITTALS

A. Product Data: For each product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are indicated and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid planting and obstructions, such as signs and light standards.
- B. Zoning Chart: Indicate each irrigation zone and its control valve.
- C. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

- D. Field quality control reports.
- E. Qualification Statements: For Installer.
- F. Delegated design engineer qualifications.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For controllers to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Spray Sprinklers: Equal to 5 percent of amount installed for each type and size indicated, but no fewer than 10 units.
 - 2. Bubblers: Equal to 5 percent of amount installed for each type indicated, but no fewer than 10 units.
 - 3. Emitters: Equal to 5 percent of amount installed for each type indicated, but no fewer than 10 units.
 - 4. Drip-Tube System Tubing: Equal to 5 percent of total length installed for each type and size indicated, but not less than 100 ft.
- B. Schedule of maintenance material items.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installers: Entity that employs a Certified Irrigation Designer - Landscape qualified by the Irrigation Association.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support piping to prevent sagging and bending.

1.9 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Irrigation Zone Control: Automatic operation with controller and automatic control valves.
- B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions, such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.
- C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:
 - 1. Irrigation Main Piping: 200 psig.
 - 2. Circuit Piping: 150 psig.

2.2 PIPES, TUBES, AND FITTINGS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.
- B. Galvanized-Steel Pipe: ASTM A53/A53M, Standard Weight, Type E, Grade B.
 - 1. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless-steel pipe with threaded ends.
 - 2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - 3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
- C. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Ductile-Iron Pipe with Push-on Joint: AWWA C151, with push-on-joint bell and spigot ends.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111 rubber.
- E. Hard Copper Tube: ASTM B88, Type L, and ASTM B88, Type M, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- F. PE Pipe with Controlled ID: ASTM D2239, PE 3408 compound; SIDR 11.5 and SIDR 15.
 - 1. Insert Fittings for PE Pipe: ASTM D2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.

- G. PE Pipe with Controlled OD: ASTM D3035, PE 3408 compound, SDR 11.
 - 1. PE Butt, Heat-Fusion Fittings: ASTM D3261.
 - 2. PE Socket-Type Fittings: ASTM D2683.
- H. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating of not less than 160 psig.
 - 1. PE Butt, Heat-Fusion Fittings: ASTM D3261.
 - 2. PE Socket-Type Fittings: ASTM D2683.
- I. PVC Pipe: ASTM D1785, PVC 1120 compound, Schedules 40 and 80.
 - 1. PVC Socket Fittings: ASTM D2466, Schedules 40 and 80.
 - 2. PVC Threaded Fittings: ASTM D2464, Schedule 80.
 - 3. PVC Socket Unions: Construction similar to that of MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.
- J. PVC Pipe, Pressure Rated: ASTM D2241, PVC 1120 compound, SDR 21 and SDR 26.
 - 1. PVC Socket Fittings: ASTM D2467, Schedule 80.
 - 2. PVC Socket Unions: Construction similar to that of MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux in accordance with ASTM B813.
- E. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 ENCASUREMENT FOR PIPING

- A. Standard: ASTM A674 or AWWA C105.
- B. Form: Sheet or tube.
- C. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.
- D. Color: Black.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."
- B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.
- C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches, to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
- D. Provide minimum cover over top of underground piping according to the following:
 - 1. Irrigation Main Piping: Minimum depth of 36 inches below finished grade, or not less than 18 inches below average local frost depth, whichever is deeper.
 - 2. Circuit Piping: 12 inches.
 - 3. Drain Piping: 12 inches.
 - 4. Sleeves: 24 inches.

3.2 PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 INSTALLATION OF PIPING

- A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.
- B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
- C. Install piping free of sags and bends.
- D. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- E. Install fittings for changes in direction and branch connections.
- F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.
- G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.
- H. Install expansion loops in control-valve boxes for plastic piping.
- I. Lay piping on solid subbase, uniformly sloped without humps or depressions.
- J. Install ductile-iron piping in accordance with AWWA C600.
- K. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.
- L. Install water regulators with shutoff valve and strainer on inlet and pressure gauge on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.

- M. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
- N. Install piping in sleeves under parking lots, roadways, and sidewalks.
- O. Install sleeves made of Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.
- P. Install transition fittings for plastic-to-metal pipe connections according to the following:
 - 1. Underground Piping:
 - a. NPS 1-1/2 (DN 40) and Smaller: Plastic-to-metal transition fittings.
 - b. NPS 2 (DN 50) and Larger: AWWA transition couplings.
 - 2. Aboveground Piping:
 - a. NPS 2 (DN 50) and Smaller: Plastic-to-metal transition unions.
 - b. NPS 2 (DN 50) and Larger: Use dielectric flange kits with one plastic flange.
- Q. Install dielectric fittings for dissimilar-metal pipe connections according to the following:
 - 1. Underground Piping:
 - a. NPS 2 (DN 50) and Smaller: Dielectric coupling or dielectric nipple.
 - b. NPS 2-1/2 (DN 65) and Larger: Prohibited except in control-valve box.
 - 2. Aboveground Piping:
 - a. NPS 2 (DN 50) and Smaller: Dielectric union.
 - b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric flange.
 - c. NPS 5 (DN 125) and Larger: Dielectric flange kit.
 - 3. Piping in Control-Valve Boxes:
 - a. NPS 2 (DN 50) and Smaller: Dielectric union.
 - b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric flange.
 - c. NPS 5 (DN 125) and Larger: Dielectric flange kit.

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Flanged Joints: Select rubber gasket material of size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.
- F. Copper-Tubing Brazed Joints: Construct joints in accordance with CDA's "Copper Tube

Handbook," using copper-phosphorus brazing filler metal.

- G. Copper-Tubing Soldered Joints: Apply ASTM B813 water-flushable flux to tube end unless otherwise indicated. Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.
- H. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
 - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join schedule number, ASTM D1785, PVC pipe and PVC socket fittings in accordance with ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings in accordance with ASTM D2855.
 - 3. PVC Nonpressure Piping: Join in accordance with ASTM D2855.

3.5 INSTALLATION OF VALVES

- A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.
- B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.
 - 1. Install valves and PVC pipe with restrained, gasketed joints.
- C. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves. Install full-size valved bypass.
- D. Throttling Valves: Install in underground piping in boxes for automatic control valves.

3.6 INSTALLATION OF AUTOMATIC IRRIGATION CONTROL SYSTEM

- A. Equipment Mounting, Interior: Install controllers on interior wall.
 - 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Equipment Mounting, Exterior: Install exterior freestanding controllers on precast concrete bases.
 - 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Install control cable in same trench as irrigation piping and at least 2 inches below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.7 CONNECTIONS

- A. Comply with requirements for piping specified in Section 33 14 15 "Site Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

C. Connect wiring between controllers and automatic control valves.

3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
 - 1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 31 20 00 "Earth Moving" for warning tapes.

3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service with Test Assistance: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 4. Irrigation system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.10 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Verify that controllers are installed and connected in accordance with the Contract Documents.
 - 3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.11 ADJUSTING

- A. Adjust settings of controllers.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

- C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.12 CLEANING

- A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.13 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controllers.

3.14 PIPING SCHEDULE

- A. Install components having pressure rating equal to or greater than system operating pressure.
- B. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.
- C. Underground Irrigation Main Piping:
 - 1. NPS 4 (DN 100) and Smaller:
 - a. NPS 3 and NPS 4 ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
 - b. NPS 3 and NPS 4 ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
 - c. Type L soft copper tube, wrought-copper fittings, and brazed joints.
 - d. NPS 4 PE pressure pipe; PE butt, heat-fusion or socket-type fittings; and heat-fusion joints.
 - e. Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.
 - f. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
 - g. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.
 - 2. NPS 5 (DN 125) and Larger:
 - a. NPS 6 and larger ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
 - b. NPS 6 and larger ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
 - c. PE pressure pipe; PE butt, heat-fusion fittings; and heat-fusion joints.
 - d. Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.
 - e. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.
- D. Circuit Piping:
 - 1. NPS 2 (DN 50) and Smaller:
 - a. SDR 7, PE, controlled ID pipe; insert fittings for PE pipe; and fastener joints.
 - b. DR 9, PE, controlled OD pipe; PE butt, heat-fusion, or PE socket-type fittings; and heat-fusion joints.
 - c. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
 - d. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100):

- a. SDR 9, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
- b. DR 11, PE, controlled OD pipe; PE socket or butt-fusion fittings; and heat-fusion joints. NPS 3 pipe and fittings if NPS 2-1/2 pipe and fittings are not available.
- c. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
- d. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

E. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

3.15 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:

1. NPS 2 (DN 50) and Smaller: Curb valve, curb-valve casing, and shutoff rod.
2. NPS 3 (DN 80) and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrench(es).

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes planting soils specified by composition of the mixes.
- B. Related Requirements:
 - 1. Section 32 93 00 "Plants" for placing planting soil for plantings.

1.2 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- H. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- I. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- J. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- K. SSSA: Soil Science Society of America.
- L. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- M. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- N. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed

areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

O. USCC: U.S. Composting Council.

P. USDA: United States Department of Agriculture

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
 - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Laboratories: Subject to compliance with requirements, provide testing by one of the following:
 - a. Wallace Laboratories, 365 Coral Cir, El Segundo, CA 90245.
 - b. Other certified local soil testing laboratory.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.

1. Notify Architect seven days in advance of the dates and times when laboratory samples

will be taken.

- B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.8 SOIL-SAMPLING REQUIREMENTS

- A. General: Extract soil samples according to requirements in this article.
- B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Architect or state-certified, -licensed, or -registered soil scientist under the direction of the testing agency or Soil Scientist who has sufficient scientific publications to demonstrate his or her expertise.
 - 1. Number and Location of Samples: Minimum of three representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
 - 2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
 - 3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
 - 4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.9 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 - 1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
 - a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
 - 2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 - 3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 - 4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D698 (Standard Proctor) or USDA Handbook No. 60, Method 34b.
- C. Chemical Testing:
 - 1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
 - 2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis -

Part 1- Physical and Mineralogical Methods."

3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action. Test plant-available forms of RCRA metals per ammonium bicarbonate-DTPA method.
 4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc using ammonium bicarbonate-DTPA method
- D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA method of ammonium bicarbonate DTPA including the following:
1. Percentage of organic matter including carbon:nitrogen ratio
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).
 4. Buffered acidity or alkalinity.
 5. Mineral nitrogen ppm.
 6. Phosphorous ppm.
 7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.
 12. Copper ppm.
 13. Sodium ppm and sodium absorption ratio.
 14. Soluble-salts ppm measured as electrical conductivity in saturation extract
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using measurement of carbon using gas chromatography after combustion method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inchdepth of soil.
 2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inchdepth of soil.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS BY COMPOSITION

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
- B. Planting-Soil: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
 1. Ratio of Loose Compost to Soil: 1:3 by volume.
 2. Ratio of Loose Sphagnum Peat to Soil: 20% by volume.
 3. Ratio of Loose Wood Derivatives Soil: 10% by volume.
 4. Weight of Lime: 40 lbs per 1000 sq. ft. per 6 inches of soil depth.
 5. Weight of Sulfur: 10 lbs per 1000 sq. ft. per 6 inches of soil depth.
 6. Weight of Agricultural Gypsum: 20 lbs per 1000 sq. ft. per 6 inches of soil depth.
 7. Weight of Triple superphosphate: 5 lbs per 1000 sq. ft. per 6 inches of soil depth.
 8. Weight of Commercial Fertilizer: 4 lbs per 1000 sq. ft. per 6 inches of soil depth.
 9. Weight of Slow-Release Fertilizer: 5 lbs per 1000 sq. ft. per 6 inches of soil depth.
 10. Unacceptable Properties: Clean soil of the following:
 - a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
 - b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.
 - c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.
 11. Amended Soil Composition: Blend imported, unamended soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
 - a. Ratio of Loose Compost to Soil: 1:3 by volume.
 - b. Ratio of Loose Sphagnum Peat to Soil: 20% by volume.
 - c. Weight of Lime: 40 lbs per 1000 sq. ft. per 6 inches of soil depth.
 - d. Weight of Sulfur: 10 lbs per 1000 sq. ft. per 6 inches of soil depth.
 - e. Weight of Agricultural Gypsum: 20 lbs per 1000 sq. ft. per 6 inches of soil depth.
 - f. Weight of triple superphosphate: 5 lbs per 1000 sq. ft. per 6 inches of soil depth.
 - g. Weight of Commercial Fertilizer: 4 lbs per 1000 sq. ft. per 6 inches of soil depth.
 - h. Weight of Slow-Release Fertilizer: 5 lbs per 1000 sq. ft. per 6 inches of soil depth.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
 - 2. Class-1: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
 - 3. Form: Provide lime in form of ground dolomitic limestone.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33/C33M.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
 - 1. Reaction: pH of 5.5 to 8.
 - 2. Soluble-Salt Concentration: Less than 4 dS/m.
 - 3. Moisture Content: 35 to 55 percent by weight.
 - 4. Organic-Matter Content: 30 to 40 percent of dry weight.
 - 5. Particle Size: Minimum of 98 percent passing through a 2-inch sieve.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
- D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - 1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances,

stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.4 FERTILIZERS

- A. Triple superphosphate: Commercial, phosphate mixture, soluble; a minimum of 45 percent available phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
 - 2. Composition-1: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
 - 2. Composition-1: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.
- D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

- A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches and stockpile until amended.
- B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
- C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

- B. Subgrade Preparation: Till subgrade to a minimum depth of 8 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
- C. Mixing: Spread unamended soil to total depth of 6 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
- D. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

- A. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
- B. Application: Spread planting soil to total depth of 6 inches, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
- C. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 BLENDING PLANTING SOIL IN PLACE

- A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 8 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
- C. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests:
 - 1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.
- B. Soil will be considered defective if it does not pass tests.
- C. Prepare test reports.

- D. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.7 PROTECTION

- A. Protection Zone: Identify protection zones according to Section 01 56 39 "Temporary Tree and Plant Protection."
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
- C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.8 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

END OF SECTION

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

1. Plant materials.
2. Fertilizers.
3. Weed-control barriers.
4. Mulches.
5. Herbicides and pesticides.
6. Tree-stabilization materials.

B. Related Requirements:

1. Section 32 84 00 "Planting Irrigation" for complete irrigation systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Plant materials.
2. Fertilizers.
3. Weed-control barriers.
4. Mulches.
5. Herbicides and pesticides.
6. Tree-stabilization materials.

B. Product Data Submittals: For each product.

1. Plant Materials: Include quantities, sizes, quality, and verified sources for plant materials.

C. Samples for Verification: Actual sample of finished products for each of the following:

1. Organic Mulch: 1-pint volume of each organic mulch required; typical of the lot of material to be furnished, in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Provide an accurate representation of color, texture, and organic makeup.
2. Mineral Mulch: 2 lb of each mineral mulch required; typical of the lot of material to be furnished, in sealed plastic bags labeled with source of mulch. Provide accurate indication of color, texture, and makeup.
3. Weed-Control Barrier: 12 by 12 inches.
4. Proprietary Root-Ball-Stabilization Device: One unit.
5. Slow-Release, Tree-Watering Device: One unit of each size required.
6. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
7. Root Barrier: Width of panel by 12 inches.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: Percolation tests for tree pits. Include the following:

1. Date of test.

2. Time when water was added to tree pit to start percolation test.
 3. Time with photo documentation showing increments of testing with water level in tree pit.
 4. Identification of tester.
- B. Qualification Statements: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with manufacturer's certified analysis of standard products.
- D. Pesticides and Herbicides: Product label and manufacturer's written application instructions specific to Project.
- E. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
1. Professional Membership: Member in good standing of either the National Association of Landscape Professionals or AmericanHort.
 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 01 40 00 "Quality Requirements."
 3. Installer's Field Supervision: Maintain an experienced full-time supervisor on Project site when work is in progress.
 4. Personnel Certification: Installer's personnel assigned to the Work certified in one of the following categories from the National Association of Landscape Professionals:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Interior.
 - c. Landscape Industry Certified Horticultural Technician.
 5. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.
- C. Measurements: Measure in accordance with ANSI Z60.1. Do not prune to obtain required sizes.
1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
- D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may

reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
 1. Do not dump or store bulk materials near structures, utilities, or walkways and pavements; or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- D. Handle planting stock by root ball.
- E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- F. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 1. Do not remove container-grown stock from containers before time of planting.
 2. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions in accordance with manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in

materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
 - b. Structural failures, including plantings falling or blowing over.
 - c. Faulty performance of tree stabilization.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Periods: From date of Substantial Completion.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: Nine months.
3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 1. Trees with damaged, crooked, or multiple leaders; with tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); with crossing trunks; with cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare in accordance with ANSI Z60.1.
- D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for plant.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to ensure symmetry in planting.

2.2 FERTILIZERS

- A. Granular Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition:
 - a. 0.75 lbs./1000 sq. ft. 3 percent of actual nitrogen, 4 percent phosphorous, and 3 percent potassium, by weight.
 - b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- B. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and maximum of 5.5 percent inert material.

2.3 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers inert to biological degradation and naturally resistant to chemicals, alkalis, and acids, formed into a stable network so that fibers retain their relative position.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd..

2.4 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
 - 1. Type: Shredded hardwood.
 - 2. Size Range: 3 inches maximum, 1/2 inch minimum.
 - 3. Color: Natural.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
- C. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:
 - 1. Type: Crushed stone or gravel.
 - 2. Size Range: 1-1/2 inches maximum, 3/4 inch minimum.
 - 3. Color: Uniform tan-beige color range acceptable to Architect.

2.5 HERBICIDES AND PESTICIDES

- A. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- B. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

- C. Pesticides: Registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended in writing by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.6 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new softwood with specified wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or turnbuckles.
3. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
4. Guy Cables: Five-strand, 3/16-inch-diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
5. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

B. Palm Bracing: Battens or blocks, struts, straps, and protective padding.

1. Battens or Blocks and Struts: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-4-inch nominal by lengths indicated.
2. Straps: Adjustable steel or plastic package banding.
3. Padding: Burlap.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 3. Suspend planting operations during periods of excessive soil moisture until moisture content reaches acceptable levels to attain required results.
 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove soil and contamination as directed by Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil in accordance with Section 32 91 13 "Soil Preparation."
- B. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate in accordance with manufacturer's written instructions.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. Do not excavate deeper than depth of root ball, measured from the root flare to the bottom of root ball.
 - 4. If area under the plant was initially dug too deep, add soil to raise it to correct level and thoroughly tamp the added soil to prevent settling.
 - 5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 6. Maintain supervision of excavations during working hours.
 - 7. Keep excavations covered or otherwise protected after working hours.
- B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
 - 1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to depth of 10 ft., whichever is less, and backfill with free-draining material.
- D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball in accordance with ANSI Z60.1. If root flare is not visible, remove soil in a level manner from root ball to where the top-most root emerges from the trunk. After soil removal to expose root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

- C. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.
 - 1. Carefully remove root ball from container without damaging root ball or plant.
 - 2. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 3. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.
 - 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines in accordance with standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- D. Do not apply pruning paint to wounds.

3.7 INSTALLATION OF TREE-STABILIZATION MATERIALS

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
 - 1. Upright Staking and Tying:
 - a. Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension indicated on Drawings above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 - b. Stake trees with two stakes for trees up to 12 ft. high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 ft. high and up to 4 inches in caliper. Space stakes equally around trees.
 - 2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
 - 3. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
- B. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than 14 ft. in height and more than 3 inches in caliper unless otherwise indicated.
 - 1. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.
 - a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to

- avoid penetrating root balls or root masses. Provide turnbuckle for each guy wire and tighten securely.
 - b. For trees more than 6 inches in caliper, anchor guys to wood deadmen buried at least 36 inches below grade. Provide turnbuckle for each guy wire and tighten securely.
 - c. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
 - d. Support trees with guy cable, connected to brass grommets of tree-tie webbing at contact points with tree trunk and reaching to compression spring. Allow enough slack to avoid rigid restraint of tree.
 - e. Attach flags to each guy wire, 30 inches above finish grade.
 - f. Paint turnbuckles with luminescent white paint.
 - 2. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and in accordance with manufacturer's written instructions.
- C. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by root ball unless otherwise indicated.
- 1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of vertical stakes.
 - a. Install stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation. Saw stakes off at horizontal stake.
 - b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
 - c. Install second set of stakes on other side of root trunk for larger trees.
 - 2. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and in accordance with manufacturer's written instructions.
- D. Palm Bracing: Install bracing system at three or more places equally spaced around perimeter of trunk to secure each palm until established unless otherwise indicated.
- 1. Site-Fabricated Palm-Bracing Method:
 - a. Place battens over padding and secure battens in place around trunk perimeter with at least two straps, tightened to prevent displacement. Ensure that straps do not contact trunk.
 - b. Place diagonal braces and cut to length. Secure upper ends of diagonal braces with galvanized nails into battens or into nail-attached blocks on battens. Do not drive nails, screws, or other securing devices into palm trunk; do not penetrate palm trunk in any fashion. Secure lower ends of diagonal braces with stakes driven into ground to prevent outward slippage of braces.
 - 2. Proprietary Palm-Bracing Device: Install palm-bracing system sized and positioned as recommended by manufacturer unless otherwise indicated and in accordance with manufacturer's written instructions.

3.8 INSTALLATION OF ROOT BARRIER

- A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.

- B. Align root barrier vertically, and run it linearly along and adjacent to paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for distance of 60 inches in each direction from tree trunk, for total distance of 10 ft. per tree. If trees are spaced closer, use single continuous piece of root barrier.
 - 1. Position top of root barrier flush with finish grade.
 - 2. Overlap root barrier minimum of 12 inches at joints.
 - 3. Do not distort or bend root barrier during construction activities.
 - 4. Do not install root barrier surrounding the root ball of tree.

3.9 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Dig holes large enough to allow spreading of roots.
- C. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to depth not less than two nodes.
- D. Work soil around roots to eliminate air pockets and leave slight saucer indentation around plants to hold water.
- E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.10 INSTALLATION OF MULCHES

- A. Install weed-control barriers before mulching in accordance with manufacturer's written instructions. Completely cover area to be mulched, overlapping edges minimum of 6 inches, and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.
 - 2. Mineral Mulch in Planting Areas: Apply 3-inch average thickness of mineral mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.11 APPLICATION OF HERBICIDES AND PESTICIDES

- A. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written instructions. Do not apply to seeded areas.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written instructions.
- C. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and in accordance with manufacturer's written instructions. Coordinate applications with Owner's operations and others in proximity to the Work. Notify

Owner before each application is performed.

3.12 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.13 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Perform tree pit percolation tests.
 - 2. Tree pit construction will be considered defective if it does not pass percolation tests and inspections.
 - 3. Do not proceed with planting in tree pits until satisfactory percolation is demonstrated.
- B. Prepare test and inspection reports.

3.14 REPAIR AND REPLACEMENT

- A. Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace trees that are more than 25 percent dead or in unhealthy condition before end of corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Species of Replacement Trees: Same species being replaced.

3.15 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

- D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

END OF SECTION

SECTION 33 10 00
FIRE WATER SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Site water distribution system for fire protection services up to 5 feet of any on-site building being served.
- B. Fire protection water transmission or distribution system within a roadway.

1.2 RELATED SECTIONS

- A. Section 31 21 00, Utility Trenching and Backfill

1.3 RELATED DOCUMENTS

A. ASME

- 1. ASME A112.1.2: Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water Connect Receptors)
- 2. ASME B1.20.1: Pipe Threads, General Purpose, Inch

B. ASTM

- 1. ASTM A536: Standard Specification for Ductile Iron Castings
- 2. ASTM A674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
- 3. ASTM D1785: Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
- 4. ASTM D2564: Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems
- 5. ASTM F1056: Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings

C. AWWA

- 1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
- 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
- 3. C110: Ductile-Iron and Gray-Iron Fittings
- 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- 5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
- 6. C116: Protective Fusion-Bonded Epoxy Coatings for the Interior & Exterior Surfaces for Ductile-Iron and Gray-Iron Fittings
- 7. C150: Thickness Design of Ductile-Iron Pipe
- 8. C151: Ductile-Iron Pipe, Centrifugally Cast
- 9. C153: Ductile-Iron Compact Fittings
- 10. C200: Steel Water Pipe 6 inch and larger

11. C205: Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 inch and Larger-Shop Applied
12. C207: Steel Pipe Flanges for Waterworks Service-Sizes 4 inch through 144 inch
13. C208: Dimensions for Fabricated Steel Water Pipe Fittings
14. C210: Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
15. C213: Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
16. C500: Metal-Seated Gate Valves for Water Supply Service
17. C502: Dry-Barrel Fire Hydrants
18. C503: Wet Barrel Fire Hydrants
19. C504: Rubber Seated Butterfly Valves.
20. C507: Ball Valves, 6 inch through 60-inches.
21. C508: Swing-check Valves for Waterworks Service, 2 inch through 48-inch NPS.
22. C509: Resilient-Seated Gate Valves for Water Supply Service
23. C510: Double Check Valve Backflow Prevention Assembly
24. C511: Reduced-Pressure Principle Backflow Prevention Assembly
25. C512: Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
26. C550: Protective Interior Coatings for Valves and Hydrants
27. C600: Installation of Ductile-Iron Water Mains and Their Appurtenances
28. C606: Grooved and Shouldered Joints
29. C651: Disinfecting Water Mains
30. C800: Underground Service Line Valves and Fittings
31. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 60 inch for Water Transmission and Distribution
32. C901: Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 inch for Water Service
33. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch through 48 inch for Water Transmission and Distribution
34. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 65 inch, for Waterworks
35. M11: Steel Pipe - A Guide for Design and Installation
36. M23: PVC Pipe – Design and Installation
37. M41: Ductile-Iron Pipe and Fittings
- D. Factory Mutual Insurance Company (FM)
 1. FM 1530: Fire Department Connections
- E. National Fire Protection Association (NFPA)
 1. NFPA 24: Installation of Private Fire Service Mains and Their Appurtenances
- F. National Sanitation Foundation (NSF)

1. NSF 61: Drinking Water System Components-Health Effects

G. Underwriters Laboratory(UL)

1. UL 262: Safety Gate Valves for Fire-Protection Service
2. UL 405: Safety Fire Department Connection Devices
3. UL 789: Indicator Posts for Fire-Protection Service

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing Materials
- C. AWWA: American Waterworks Association
- D. DI: Ductile iron
- E. DIP: Ductile iron pipe
- F. FM: Factory Mutual
- G. NFPA: National Fire Protection Association
- H. NSF: National Sanitation Foundation
- I. PCC: Portland cement concrete
- J. PE: Polyethylene
- K. PVC: Polyvinyl Chloride
- L. UL: Underwriters Laboratory

1.5 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Internal Pressures: As indicated on Plans.
- B. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless indicated otherwise.

1.6 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Product Data: Manufacturer's literature and data, including, where applicable, sizes, pressure rating, rated capacity, listing/approval stamps, labels, or other marking on equipment made to the specified standards for materials, and settings of selected models, for the following:
 1. Piping materials and fittings
 2. Gaskets, couplings, sleeves, and assembly bolts and nuts
 3. Flexible pipe fittings
 4. Restrained pipe fittings

5. Expansion joints
 6. High deflection fittings/ball joints
 7. Gate valves
 8. Butterfly valves
 9. Check valves
 10. Ball valves
 11. Air release, air/ vacuum and combination air valves
 12. Blow-off valves
 13. Pressure reducing valves
 14. Flow Regulating valves
 15. Service connections and water meters
 16. Valve boxes, meter boxes, frames and covers
 17. Backflow preventers
 18. Fire hydrants
 19. Post indicator valves
 20. Fire department connections
 21. Thrust block concrete mix
 22. Tapping sleeves and tapping valves
 23. Service saddles and corporation stops
 24. Identification materials and devices
- C. Shop Plans and Calculations: Where an on-site fire water system is required, Contractor shall provide shop plans for Engineer and agency approval prior to construction. Coordinate with the Plans and identify any proposed modifications or deviations. Shop Plans and Calculations shall be stamped and signed by a registered Fire Protection Engineer licensed by the State of California as required.
1. Include the following information:
 - a. Design assumptions
 - b. Thrust block sizing and calculations
 - c. Materials to be used
 - d. Available water pressure
 - e. Required water pressure
 2. The review of fire system components constitutes only a portion of the review and approval required. A copy of the fire system component submittal package shall be forwarded to the local fire marshal for further review and approval.
- D. Water Pressure Report: At the conclusion of work, the Contractor shall engage a qualified testing service to conduct a flow test of the existing system (providing flow test data for all mains and at least six (6) hydrants). Provide date and location of test, type and method of test performed, static pressure and residual pressure in psig, observed flow in gpm, and orifice size.

- E. Shop drawings: Include plans, elevations, details and attachments.
 - 1. Precast and cast in-place vaults and covers
 - 2. Wiring diagrams for alarm devices
- F. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

1.7 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.
- B. Comply with the following requirements and standards:
 - 1. NFPA 24: "Installation of Private Fire Service Mains and Their Appurtenances" for materials, installations, tests, flushing, and valve and hydrant supervision.
 - 2. NFPA 70: "National Electric Code" for electrical connections between wiring and electrically operated devices.
- C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

1.8 MATERIAL DELIVERY, STORAGE AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.
- C. Handling: Use slings to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. During Storage: Use precautions for valves, including fire hydrants according to the following.
 - 1. Do not remove end protectors, unless necessary for inspection, then reinstall for storage.
 - 2. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- E. Do not store plastic pipe and fittings in direct sunlight.
- F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.

- G. Protect linings and coatings from damage.
- H. Handle precast boxes, vaults and other precast structures according to manufacturer's written instructions.
- I. Protect imported bedding and backfill material from contamination by other materials.

1.9 COORDINATION

- A. Coordinate connection to existing water mains with water utility supplying water.
- B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

PART 2 PRODUCTS

2.1 DIP: SIZES 4 INCH THROUGH 48 INCH

- A. Pipe: Pressure Class 350 pipe conforming to AWWA C151, AWWA Manual M41 and standard thickness per AWWA C150. U.S. Pipe, American Cast Iron Pipe Company, or approved equal.
- B. Fittings: Provide fittings with pressure rating greater than or equal to that of the adjoining pipe.
- C. Pipe and Fitting Lining: Cement Mortar, AWWA C104.
- D. Pipe and Fitting Coating: Asphaltic, AWWA C151 or C115.
- E. Fittings
 - 1. Standard: AWWA C110, sizes 4 inch through 48 inch.
 - 2. Compact: AWWA C153, sizes 4 inch through 24 inch.
 - 3. All fittings shall be fusion epoxy coated per AWWA C116.
- F. Exterior Soil Corrosion Protection for Pipe and Fittings: Polyethylene encasement, AWWA C105.
- G. Unrestrained Joints (Rubber Gasket Joints):
 - 1. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111.
 - 2. Mechanical Joint: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111.
- H. Restrained Joints:
 - 1. Flanged Joint: Provide bolts, nuts, and gaskets in conformance with AWWA C115. Gaskets shall conform to the requirements specified in AWWA C111. Unless otherwise required, above ground flange assembly bolts shall be standard hex-head, cadmium plated machine bolts with American Standard Heavy, hot-pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts shall be as above except they shall be of Type 304 stainless steel.
 - 2. Push-On Bell and Spigot Joint: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA C111 with "Field Lok Gasket,"

sizes 4 inch through 24 inch, "TR Flex," sizes 4 inch through 64 inch; both by U. S. Pipe, or approved equal. "Megalug" restraint harness, EBAA Iron, or approved equal.

3. Mechanical Joint: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111 with "Megalug," sizes 3 inch through 48 inch, EBAA Iron, or approved equal.

I. Insulating Joints:

1. Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
2. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
3. Provide gasket of the dielectric type, full face, as recommended in AWWA C115.
4. Provide bolts and nuts as recommended in AWWA C115.

2.2 PE PIPE: SIZES 4 INCH THROUGH 64 INCH

A. Pipe and Fittings: AWWA C906

B. Joints:

1. Thermal Butt Fusion: AWWA C906 and pipe manufacturer's recommendations
2. Flanged joints: AWWA C906 and pipe manufacturer's recommendations

2.3 PVC PIPE: SIZES 4 INCH THROUGH 48 INCH

A. Pipe: Pressure Class 200, DR 11, spigot and gasket bell end, conforming to AWWA C900 (4 inch through 12 inch and AWWA C905 (14 inch through 48 inch)

B. Fittings: Ductile iron fittings

1. Standard: AWWA C110, sizes 4 inch through 48 inch
2. Compact: AWWA C153, sizes 4 inch through 24 inch
3. All fittings shall be fusion epoxy coated per AWWA C116

C. Unrestrained Joints: Push-On Bell and Spigot Joint: AWWA C900

D. Restrained Joints:

1. Push-On Bell and Spigot Joint: Harness assembly as manufactured by EBAA Iron, or approved equal.
2. Plain End PVC to Ductile Iron Mechanical Joint: EBAA Iron, or approved equal.

E. Steel or Ductile Iron Couplings:

1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219.
2. Plain End Pipe to Ductile Iron or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219.

F. PVC Couplings:

1. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by North American Pipe approved equal.
2. Restrained Plain End to Plain End Pipe: AWWA C900, "Fluid-Tite" as manufactured by North American Pipe, or approved equal.

2.4 HIGH DEFLECTION FITTINGS/BALL JOINTS

- A. Plain End Pipe: Xtra Flex Restrained Joint High Deflection Fittings, 4 inch through 24 inch, U. S. Pipe, or approved equal.
- B. Mechanical or Flanged Joint: Flex 900, 4 inch through 12 inch, EBAA Iron, or approved equal.

2.5 GATE VALVES

- A. Provide valves conforming to AWWA C500 or AWWA C509
- B. Valves shall be resilient-seated, with non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise.
- C. All bolts, nuts and washers, except operating nut, shall be stainless steel.
- D. Stem operating nut to be 2 inches square and open counter-clockwise.
- E. Stem extensions shall be installed to bring the stem operating nut to within 2 feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4 feet.
- F. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- G. Where a post indicator is shown, provide valve with an indicator post flange.
- H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
 1. Mueller Co
 2. Clow Company
 3. American AVK, or approved equal

2.6 BUTTERFLY VALVES

- A. AWWA C504, rubber seated, Class 150B ductile iron body and discs, stainless steel shafts, adjustable field replaceable rubber seats mating against stainless steel seat rings and field-replaceable seals.
- B. Flanged or mechanical joint end connections.
- C. No wafer type valves allowed.
- D. Traveling nut type valve actuators designed for buried service unless noted otherwise.
- E. All bolts, nuts and washers, except wrench nut, shall be stainless steel.
- F. Wrench nut to be 2 inches square and open counter-clockwise.

- G. Stem extensions shall be installed to bring the wrench nut to within 2 feet of finish grade where the depth from finish grade to the wrench nut exceeds 4 feet.
- H. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- I. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Mueller Co
 - 2. Clow Company
 - 3. American AVK, or approved equal

2.7 SWING CHECK VALVES

- A. Provide swing-check type valves conforming to AWWA C508.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Prince
 - 2. DeZurik/APCO, or approved equal

2.8 BALL VALVES

- A. Provide ball valves (6 inch through 48 inch) per AWWA C507 as manufactured by Crane Company, or approved equal.
- B. Valves shall open by counterclockwise rotation of the valve stem.
- C. Provide valves with ends as appropriate for the adjoining pipe.
- D. Provide valve with lockable operating nut or handle as shown on the Plans.

2.9 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES

- A. Air release and vacuum valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Jones, DeZurik/APCO or approved equal.
- B. Combination air valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve or double valve body, and shall conform to AWWA C512. A simple or compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
 - 1. Jones

2. Mueller Co
3. DeZurik/APCO, or approved equal

2.10 BLOW-OFF VALVES

- A. Provide valve and service size as shown in the Plans. Provide 2 inch valves at low points of the piping system, and 4 inch valves at dead-ends of the piping system, unless otherwise directed by the Engineer.
- B. 2 inch blow-off shall have a 2 inch vertical female iron pipe (FIP) inlet and a 2 inch normal pressure and temperature (NPT) nozzle outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16 inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF550, or approved equal.
- C. 4 inch blow-off shall have all brass principal working parts, 4 inch inlet and outlet and is self-draining and non-freezing. Valve shall open by counterclockwise rotation of a top-mounted 2 inch square operating nut. All working parts shall be serviceable without excavation.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
- E. Jones, or approved equal

2.11 PRESSURE-REDUCING VALVES

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment.
- B. Valves shall have flanged ends. Valves sized 3 inches or smaller may have screwed ends.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. Cla-Val Company
 2. Bermad
 3. Ames Company, or approved equal

2.12 FLOW-REGULATING VALVES

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment. Details as indicated.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. Cla-Val Company
 2. Bermad
 3. Ames Company, or approved equal

2.13 VALVE BOXES, METER BOXES, FRAMES AND COVERS

- A. Water Valve Box: Provide pre-cast concrete valve box for each buried valve. Provide box with steel or cast iron traffic cover marked "WATER". Christy, Armorcast, Jensen Pre-cast, or approved equal.
- B. Valve or Meter Boxes: Contractor shall verify box size required for water system appurtenances as shown in the Construction Documents. Provide a precast concrete utility box for each buried appurtenance. Provide a traffic-rated lid for H2O loading. A non-traffic rated lid may be used for boxes located in landscape areas. Christy, Armorcast, Jensen Pre-cast, or approved equal.

2.14 BACKFLOW PREVENTER - REDUCED PRESSURE PRINCIPLE ASSEMBLIES (RPPA)

- A. Provide RPPA consisting of two independently operating check valves with a pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. RPPA shall be tamper-proof and conform to AWWA C511. Valve shall have an outside screw (OS) gate valve on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application.
- B. Body:
 - 1. 2 ½ inch and Larger: Bronze, cast iron steel, or stainless steel with flanged ends
- C. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies
- D. Interior Components: Corrosion-resistant materials
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Cla-Val Company
 - 2. Ames Company
 - 3. Febco, CMB Industries, Inc.
 - 4. Hersey Products, Inc.
 - 5. Watts
 - 6. Zurn/Wilkins, or approved equal

2.15 BACKFLOW PREVENTER - DOUBLE CHECK DETECTOR ASSEMBLY (DCDA)

- A. Provide a cast-iron body DCDA consisting of mainline double check assemblies in parallel with a bypass double check and meter assembly, two shut-off valves and four test cocks. DCDA shall be tamper-proof and conform to AWWA C510. FM approved or UL listed, with outside screw and yoke (OS&Y) gate valve on inlet and outlet, and strainer on inlet. Include two positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:

1. Cla-Val Company
2. Ames Company
3. Febco, CMB Industries, Inc.
4. Hersey Products, Inc.
5. Zurn/Wilkins, or approved equal

2.16 POST INDICATOR VALVE

- A. General: UL 789, FM approved, vertical-type, cast-iron body with operating wrench extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. Mueller Company
 2. Clow Corporation
 3. American Cast Iron Company

2.17 FIRE DEPARTMENT CONNECTION

- A. Exposed, sidewalk or Freestanding Type Fire Department Connection: UL 405, cast brass body with threaded inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets and chains; lugged swivel connections and drop clapper for each hose-connection inlet; 18-inch-high brass sleeve; and round escutcheon plate. Number of inlets shall be as shown on the Plans. Clapper and spring check inlets shall each have a minimum capacity of 250 gpm and be furnished with a cap and chain. Outlet shall be sized for simultaneous use of all inlets. Connection shall be branded "Building XX".
 1. 2-Way FDC: Connection shall conform to UL 405 or FM 1530. Elkhart, Croker, or approved equal.
 2. 3-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Elkhart, Croker, Potter-Roemer or approved equal.

2.18 FIRE HYDRANTS

- A. Provide two 2 ½ inch and one 4-inch outlets, with a 6 inch nominal inside diameter inlet and break-away type bolts. Hydrant shall have a working pressure of 250 psi and shall conform to C503 and be UL listed and FM approved. Provide hydrants of one manufacturer. Clow model 850 series or approved equivalent, subject to approval of the Owner and fire marshal.

2.19 THRUST BLOCKS

- A. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 ½ parts sand, and 5 parts gravel, having the same minimum compressive strength.
- B. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.

- C. Where depth or location of existing structures prohibit the use of standard thrust blocks, gravity blocks may be used.

2.20 TAPPING SLEEVES AND TAPPING VALVES

- A. Tapping sleeves shall be epoxy coated and furnished with stainless steel washers, nuts and bolts. Mueller H-615 and H-619, Ford, or approved equal.
- B. Tapping valves shall have flanged inlet, Class 125, conforming to ASME B16.1 and furnished with stainless steel washers, nuts and bolts. Tapping valves shall be constructed with a mechanical joint outlet. Mueller T-687, T-642, T-681, or approved equal.

2.21 SERVICE SADDLES AND CORPORATION STOPS

- A. Service Saddles: Saddles shall conform to AWWA C800 and NSF 61.
 - 1. For DIP: Provide bronze or stainless-steel body, double strap type with a 200 psi maximum working pressure. Mueller Co. or approved equal.
 - 2. For PVC: Provide bronze body, wide strap type. Mueller H-615, or approved equal.
 - 3. For PE: Per manufacturer's recommendations.
- B. Corporation Stops: Provide ground key type; bronze conforming to ASTM B61 or ASTM B62, for a working pressure of 100 psi and suitable for the working pressure of the system.
 - 1. Ends shall be suitable for adjoining pipe and connections, solder-joint, or flared tube compression type joint.
 - 2. Threaded ends shall conform to AWWA C800.
 - 3. Coupling nut for connection to flared copper tubing shall conform to ASME B16.26.
 - 4. Mueller H Series with "CC" threads and a copper flare straight connection outlet, Ford, or approved equal.

2.22 IDENTIFICATION MATERIALS AND DEVICES

- A. Warning Tape: Provide warning tape consisting of metallic foil bonded to solid blue plastic film not less than 3 inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1 mil thick. The tape continuously shall have printed black-letter, not less than 3/4 inch high, message reading "CAUTION: WATER MAIN BELOW".
- B. Tracer Wire for Nonmetallic Piping: Provide 12 guage, coated copper or aluminum wire not less than 0.10 inch in diameter, with blue THW, THWN, or THHN rated insulation, in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

- A. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) shown on the Plans.
- B. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00 – Utility Trenching and Backfill.

- C. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- D. Pipe laying and jointing:
1. Provide proper facilities for lowering sections of pipe into trenches.
 2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
 3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
 5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
 6. Support pipe at proper elevation and grade.
 7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
 8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 9. Provide anchors and supports where indicated and where necessary for fastening work into place.
 10. Make proper provision for expansion and contraction of pipelines.
 11. Keep trenches free of water until joints have been properly made.
 12. Do not lay pipe when conditions of trench or weather prevent proper installation.
 13. All fittings shall be blocked with appropriately sized thrust blocks as shown on the Plans.
- E. Installation of Tracer Wire:
1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
 3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
 4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.
- F. Installation of Warning Tape
1. Install tape approximately 1 foot above and along the centerline of the pipe.
 2. Where tape is not continuous, lap tape ends a minimum of 2 feet.

- G. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- H. Connections to Existing Lines:
 - 1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
 - 2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.
- I. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.2 INSTALLATION OF DUCTILE-IRON PIPING

- A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.
- B. Jointing:
 - 1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
 - 2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
 - 3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.
 - 4. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
 - 5. Align bolt holes for each flanged joint.
 - 6. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
 - 7. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.
 - 8. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
 - 9. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the setscrewed flange manufacturer.
 - 10. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.
 - 11. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

- C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 8 mil linear low-density polyethylene (LLD) film or 4 mil high-density cross-laminated (HDCL) film per manufacturer's recommendations and in accordance with AWWA/ANSI C105/A21.5 and ASTM A674.
- D. Pipe Anchorage: Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.3 INSTALLATION OF POLYVINYL CHLORIDE PIPING

- A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA Manual M23.
- B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.
- C. Jointing:
 - 1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
 - 2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
 - 3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 - 4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
 - 5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
 - 6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
 - 7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- D. Pipe Anchorage:
 - 1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.4 INSTALLATION OF POLYETHYLENE PIPING

- A. Install pipe, fittings, and appurtenances in accordance with manufacturer's recommendations.
- B. Jointing:
 - 1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
 - 2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
 - 3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.

4. Butt fusion:

- a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
- b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
- c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
- d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
- e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the manufacturer's recommendations for temperature, pressure, holding, and cooling times.
- f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.

5. Socket fusion:

- a. Mixing manufacturers' heating tools and depth gauges will not be allowed unless the tools conform to ASTM F1056.
- b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
- c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
- d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
- e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
- f. Simultaneously remove the pipe and fitting from the tool.
- g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
- h. Hold or block the pipe in place during cooling.

6. Electrofusion:

- a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
- b. Clamp the pipe and fitting at the proper position in the fixture.
- c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
- d. Allow the joint to cool before removing the clamping fixtures.

3.5 INSTALLATION OF VALVES

A. Gate Valves

1. Install gate valves conforming to AWWA C500 and UL 262 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, operation, and Maintenance of Gate Valves) to AWWA C509.
2. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509.
3. Install gate valves on PVC water mains in addition in accordance with the recommendations for appurtenance installation in AWWA Manual M23.

B. Butterfly Valves: Install butterfly valves in accordance with the applicable requirements of Appendix A of AWWA C504.

C. Check Valves: Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.

D. Joints:

1. Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.
2. Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

3.6 INSTALLATION OF VALVE AND METER BOXES

- A. Boxes shall be centered over the appurtenance so as not to transmit shock or stress. Covers shall be set flush with the surface of the finished pavement, or as shown on the Plans. Backfill shall be placed around the boxes and compacted to the specified level in a manner that will not damage or displace the box from proper alignment or grade. Misaligned boxes shall be excavated, plumbed, and backfilled at no additional cost to the Owner.

3.7 INSTALLATION OF FIRE HYDRANTS

- A. Install fire hydrants, except for metal harness, plumbed vertical, in accordance with AWWA C600 for hydrant installation and as indicated.
- B. Provide and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Hydrants shall be set so that mounting bolts clear the top of finished grade by three inches so bolts may be easily replaced if needed.
- C. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.

3.8 SERVICE LINE CONNECTIONS TO WATER MAINS

- A. Connect service lines of size shown on plans to the main with a rigid connection or a corporation stop and gooseneck. Install a gate valve on the service line.
- B. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.

- C. Connect service lines to PVC plastic water mains in accordance with the recommendations of AWWA Manual M23.

3.9 INSTALLATION OF BACKFLOW PREVENTERS

- A. Backflow devices shall be installed horizontal and level, with three feet minimum clearances from obstructions.

3.10 ANCHORAGE INSTALLATION

- A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.
- B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24 hours curing time before introducing water into the pipeline and allow a minimum of 7 days curing time before pressure testing.

3.11 CONNECTION TO EXISTING

- A. Contractor shall submit a work plan delineating the work sequence and duration of each task.
- B. The Contractor to submit a contingency plan in case work extends beyond the allowable shutdown duration
- C. The total allowed duration of shutdown shall not exceed the time period agreed upon between the owner and contractor. Any day exceeding this period will accrue liquidated damages per day. Amount per day to be agreed upon between owner and contractor.
- D. Contractor to notify Owner 48 hours prior to shutdown.
- E. Prior to shutdown the Contractor shall have the following:
 - 1. Approved submittals for the work to be done
 - 2. Approved work plan
 - 3. Approved contingency plan
 - 4. The material, tools and equipment necessary to do the work, including pumps, generator, lighting, etc.
- F. No work shall be done within two weeks from a wet weather event.
- G. Contractor to check the weather (NOAA website) and plan work during dry weather period.

3.12 HYDROSTATIC PRESSURE AND LEAKAGE TEST

- A. General:
 - 1. Provide all necessary materials and equipment, including water.
 - 2. Backfill all trenches sufficient to hold pipe firmly in position.
 - 3. Allow time for thrust blocks to cure prior to testing.
 - 4. Flush all pipes prior to testing to remove all foreign material.
 - 5. Perform pressure and leakage test concurrently.
 - 6. Apply test pressure by means of a pump connected to the pipe.

7. Base test pressure on the elevation of the lowest point in the line.
8. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
9. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
10. The pressure test on mortar-lined pipe shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption in the cement mortar lining.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.

B. Preparation for Test

1. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
2. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
3. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.
4. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.
5. A joint previously tested in accordance with this specification may be covered or insulated.
6. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
7. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.

C. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:

1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (S \times D \times P^{1/2}) / 133,200$$

L = Allowable leakage, gallons per hour.

S = Length of pipe tested, feet.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

D. PE Pipe Leakage Test:

1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
3. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for four hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.

Nominal Pipe Size (in.) Test	Allowance for Expansion (U.S. Gals./100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

- E. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:

1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P^{1/2}) / 7,400$$

L = Allowable leakage, gallons per hour.

N = Number of joints in the length of the pipeline tested.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

- F. Cement Mortar Lined and Coated Steel Pipe Leakage Test: Perform in accordance with AWWA M11. Selected requirements of AWWA M11 are repeated as follows:
1. All pipelines shall be tested by subjecting each section to a pressure, measured at the lowest end of the section, of at least 150 percent of the class rating or design pressure of the pipe under test. In no case shall the pipe be tested at less than 150 psi, nor shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
 3. There shall be no significant leakage for pipe with welded joints or mechanical couplings.
 4. For pipe joined with O-ring rubber gaskets, a leakage of 25 gallons per inch of diameter per mile per 24 hours is allowed.

3.13 CLEANING

- A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Owner will examine the pipes for leaks. If any further defective pipes or joints are discovered, the Contractor shall repair them. Finished paving shall not be installed prior to completion of all cleaning and testing.

3.14 DISINFECTION OF PIPELINES

- A. After completion of the hydrostatic test, the mains shall be thoroughly flushed with a minimum pipe velocity of 2.5 fps and chlorinated in accordance with the latest revision of AWWA 651, Standards of Disinfecting Water Mains. Any one of the methods therein described may be used, with the additional requirement of 50 ppm chlorination minimum initial application. At the end of the contact period, the mains shall again be flushed, and bacteriological samples taken.

- B. If necessary, the Contractor shall provide, at his expense, outlets from which to take the samples. The location of the chlorination and sampling points will be determined by the Owner in the field. Taps for chlorination and sampling shall be installed. The Contractor shall uncover and backfill the taps as required.
- C. Disinfection of tie-ins shall be performed by the Contractor by swabbing with chlorine or by other approved methods. Following a tie-in, the area affected by the tie-in shall be thoroughly flushed and bacteriological samples will be taken as deemed necessary.
- D. All treated water flushed from the lines shall be dechlorinated and disposed of by discharging to the locations identified in the Plans, or by other approved means. No discharge of chlorinated water to any storm sewer or natural water course will be allowed, unless properly dechlorinated.
- E. The Contractor shall rechlorinate and retest any lines that do not meet the requirements of the above testing. The line shall not be placed in service until the requirements of the State Public Health Department are met.

3.15 BACTERIOLOGICAL TESTING

- A. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory approved by the Owner.
- B. Water samples are to be taken at representative points no less than one test per 500 feet of pipe, plus one test at each end of the pipe; or as required by the Owner.
- C. After the samples have passed the bacteriological testing, the Contractor will be notified and arrangements can be made to make tie-ins and connections to house services.
- D. Each water sample will have passed the bacteria tests if they show zero total coliform per 100 ml and not more than 50 non-sheen bacteria per 100 ml, and when the turbidity is no greater than the source water.
- E. Samples shall be taken no sooner than 24 hours after final flushing.
- F. Jumpers and/or plates shall be pulled within 14 days of the notification of a successful test, or new bacteria samples will have to be taken.
- G. Follow-up bacteriological testing shall take place after tie-ins have been made, and shall meet the same passing requirements as the initial tests.

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roadway and/or site storm drainage system up to five feet of any on-site building

1.2 RELATED SECTIONS

- A. Section 31 21 00, Utility Trenching and Backfill
- B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.3 RELATED DOCUMENTS

A. AASHTO

- 1. M199: Precast Reinforced Concrete Manhole Sections
- 2. M252: Corrugated Polyethylene Drainage Pipe
- 3. M294: Corrugated Polyethylene Pipe, 12 to 604 inch Diameter

B. ASTM

- 1. A74: Cast Iron Soil Pipe and Fittings
- 2. A615: Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- 3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
- 4. C443: Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- 5. C478: Circular Precast Reinforced Concrete Manhole Sections
- 6. C564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- 7. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
- 8. C1173: Flexible Transition Couplings for Underground Piping Systems
- 9. D1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- 10. D2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
- 11. D2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
- 12. D3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- 13. D4101: Propylene Injection and Extrusion Materials
- 14. F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- 15. F656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- 16. F679: Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- 17. F1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings

C. AWWA

1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water
4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. C115: Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
7. C150: Thickness design of Ductile Iron Pipe
8. C151: Ductile-Iron Pipe, Centrifugally Cast
9. C153: Ductile-Iron Compact Fittings
10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
11. M41: Ductile Iron Pipe and Fittings

D. Caltrans Standard Specifications, 2015

1. Section 51, Concrete Structures
2. Section 52, Reinforcement
3. Section 65, Concrete Pipe
4. Section 66, Corrugated Metal Pipe
5. Section 70, Miscellaneous Drainage Facilities
6. Section 72, Slope Protection
7. Section 75, Miscellaneous Metal
8. Section 90, Concrete

E. Caltrans Standard Plans, 2015

1. Plan D94A: Metal and Plastic Flared End Sections
2. Plan D94B: Concrete Flared End Sections
3. Plan D97A: Corrugated Metal Pipe Coupling Details No. 1, Annular Coupling Band Bar and Strap and Angle Connection
4. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers
5. Plan D97D: Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands
6. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint
7. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint
8. Plan D97G: Corrugated Metal Pipe Coupling Details No. 7, Downdrain
9. Plan D98A: Slotted Corrugated Steel Pipe Drain Details
10. Plan D98B: Slotted Corrugated Steel Pipe Drain Details

1.4 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials

- B. ASTM: American Society for Testing Materials
- C. AWWA: American Water Works Association
- D. CMP: Corrugated metal pipe
- E. DIP: Ductile iron pipe
- F. HDPE: High-density polyethylene
- G. NPS: Nominal pipe size
- H. PE: Polyethylene
- I. PVC: Polyvinyl Chloride
- J. RCP: Reinforced concrete pipe

1.5 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Product data for the following:
 - 1. Piping materials and fittings
 - 2. Special pipe couplings
 - 3. Polymer-concrete, channel drainage systems (trench drains)
 - 4. Joint sealants
 - 5. Plastic area drains
 - 6. Cleanout plugs or caps
 - 7. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates
 - 8. Precast clean out boxes and box covers
 - 9. Concrete, metal and plastic flared end sections
- C. Shop drawings: Include plans, elevations, details and attachments for the following:
 - 1. Precast concrete manholes, frames and covers
- D. Design Mix Reports and Calculations: For each class of cast in place concrete
- E. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage
 - 1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling
 1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
 2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.
 3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 PRODUCTS

2.1 PE PIPE AND FITTINGS (HDPE): 4 INCH THROUGH 10 INCH

- A. Pipe shall be in accordance with AASHTO M252 Type S, smooth interior and corrugated exterior
- B. Bell and spigot joints
- C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477
- D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.2 PE PIPE AND FITTINGS (HDPE): 12 INCH THROUGH 48 INCH

- A. Pipe shall be in accordance to AASHTO M294. Type S, smooth interior and corrugated exterior.
- B. Bell and spigot joints
- C. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F477
- D. Couplings: AASHTO M252, corrugated band type, engage a minimum of 4 corrugations, 2 on each side of pipe joint

2.3 PVC PIPE AND FITTINGS-SMALLER THAN 4 INCH

- A. Pipe shall be in accordance to ASTM D1785, Schedule 40. [Check external load and laying condition, schedule 80 and 120 are also available if stronger pipe is required.]
- B. Joints: Solvent Cement, ASTM D2564
- C. Include primer according to ASTM F656
- D. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.4 PIPE ANCHORS

- A. General: Location, configuration bearing area, etc. as indicated

- B. Portland Cement Concrete: Section 32 13 18, Cement and Concrete for Exterior Improvements

2.5 PIPE CLEANOUTS

- A. Piping: Same as storm drain line if possible
- B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.
- C. Box Size: As required to provide access and allow easy removal and reinstallation of cap
- D. Box Types
 - 1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty
 - 2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading
- E. Box Cover Markings: "S.D.," unless otherwise specified
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
 - 1. Associated Concrete Products, Inc.
 - 2. Brooks Products Inc.
 - 3. OldCastle Precast/Christy Concrete Products, Inc.

2.6 AREA DRAINS

- A. Grate and Riser: Area drain shall be as manufactured by Nyloplast or approved equal. Riser shall be constructed of 6 inch PVC SDR 35 and connected to area drain by a gasket joint. Riser shall be vertical except as otherwise noted in the plans. Riser may include a reducer if necessary to make connection to the storm drain line.
- B. Elevation and Grading: Area Drain rim elevation shall be set and area around area drain shall be graded to drain away from any adjacent structures, walks, or roadways and towards area drain.

2.7 CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

- A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.
- B. Portland Cement Concrete and Reinforcing: Section 32 13 18, Cement and Concrete for Exterior Improvements.
- C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.
- D. Steps: ASTM C 478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091).

- E. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75-1.02.B and 75-2
 - 1. Galvanize steel frames, grates and covers
 - 2. Grates and covers shall be non-rocking
 - 3. Rate for AASHTO H20 loading in traffic areas

2.8 MANHOLES

- A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans and shall conform to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor's option. Concrete shall consist of Caltrans Type I/II cement. Rate for AASHTO H20 loading in traffic areas.
- B. All interior concrete surfaces shall be coated with "Xypex Crystalline" or approved equivalent. Use of a water-resistant admix is acceptable, at Contractor option.
- C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-2.02B. Manhole covers shall have the words "STORM DRAIN" in letters not less than 2 inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.
- D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.
- E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Plans. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.
- F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Caltrans Standard Specifications Section 90 and as herein specified. The concrete shall be Class "A" containing six (6) sacks of portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the CDT requirements of the three-quarter inch maximum. The consistency of the fresh aggregate shall be such that the slump does not exceed four inches, as determined by ASTM C143. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.
- G. Steps: ASTM C478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, or approved equal.

2.9 JOINT SEALANT FOR PRECAST STRUCTURES AND MANHOLES

- A. Mortar: Caltrans Standard Specification Section 51-1.02F
 - 1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.
- B. Gaskets: Preformed flexible rubber or plastic gasket
 - 1. Rubber Gaskets: ASTM C443
 - 2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form;

or alternate standard which may exist. Acceptable material is "Ram-Nek," as manufactured by Henry Company, or approved equal.

2.10 PIPE TO STRUCTURE CONNECTOR/SEAL

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast and/or cast-in-place concrete structures.
 - 1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
 - 2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector and stainless-steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.
 - 3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
 - 4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

2.11 SLOPE PROTECTION

- A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.02B
 - 1. Class: XX
 - 2. Fabric: Caltrans Standard Specification Section 72-2.02C
- B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-5
 - 1. Bar Reinforcement: Caltrans Standard Specification Section 52-1.02B, minimum Grade 40
 - 2. Welded Wire Fabric: Caltrans Standard Specification Section 52-1.02C. Use 6 x 6-W1.4 x W1.4 unless otherwise indicated.
- C. Concreted-Rock Slope Protection: Caltrans Standard Specification Section 72-3
 - 1. Class: **xx**
- D. Sacked Concrete Slope Protection
 - 1. Concrete: Section 32 13 18 Cement and Concrete for Exterior Improvements
 - 2. Sacks: 10-ounce burlap measuring approximately 19.5 inches by 36 inches when empty and laid flat

PART 3 EXECUTION

3.1 PIPE INSTALLATION

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03 for reinforced concrete pipe, Caltrans Standard Specification Section 66-1.03 for corrugated metal pipe, and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.2 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Manufacturers' instructions

3.3 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC. AND MANHOLES

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
 - 1. Shape bottoms to convey flows as indicated.
- C. Precast Structures: Install as indicated.

1. Seal all joints and pipe entrances and exits.
2. Place concrete in bottom and shape to convey flows as indicated.

3.4 SLOPE PROTECTION PLACEMENT

- A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.03 and as indicated.
 1. Use Method B Placement unless otherwise indicated.
- B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-5.03
- C. Concreted-Rock Slope Protection: Caltrans Standard Specification Section 72-3.03
 1. Use Method B Placement unless otherwise indicated.
- D. Sacked Concrete Slope Protection
 1. Detailed configuration: As indicated
 2. Use one cubic foot of concrete per sack.
 3. Locate headers and stretchers as indicated.
 4. Headers: Folded end to bank
 5. Stretchers: Folded ends are not to be adjacent.
 6. Place no more than four vertical courses until initial set has taken place in first course.

3.5 POURED-IN-PLACE CONCRETE

- A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of Caltrans Standard Specifications.
- B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Plans, exposed surfaces of structures shall be Class 1 surface finish.
- C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.
- D. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.6 PIPELINE FLUSHING

- A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.
- B. Pull-Through Device:
 1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
 - a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.

- b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
- 2. Ball, cylinder, or circular sections shall conform to the following:
 - a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
 - b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
 - c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
 - d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
- 3. Pull-Through Device:
 - a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
 - b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.

3.7 CLEANING

- A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

3.8 TELEVISION INSPECTION

- A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the drain line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the Owner for review.
- B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
 - 1. Low spot (1 inch or greater - mainlines only)
 - 2. Joint separations (3/4 inch or greater opening between pipe sections)
 - 3. Cocked joints present in straight runs or on the wrong side of pipe curves.
 - 4. Chips in pipe ends
 - 5. Cracked or damaged pipe
 - 6. Dropped joints
 - 7. Infiltration
 - 8. Debris or other foreign objects
 - 9. Other obvious deficiencies
 - 10. Irregular condition without logical explanation

END OF SECTION

SECTION 33 46 00

SUBDRAINAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Subdrains in trenches and subdrains or prefabricated composite drainage panels at walls or foundations
- B. Bioretention and biofiltration areas for storm water treatment

1.2 RELATED SECTIONS

- A. Section 31 23 33, Utility Trenching and Backfill
- B. Section 33 41 00, Storm Utility Drainage Piping

1.3 RELATED DOCUMENTS

- A. Geotechnical Report: [Insert Report Title, Company, and Report Date].
- B. AASHTO
 - 1. M288: Standard Specification for Geotextiles Used for Subsurface Drainage Purposes
- C. ASTM
 - 1. C1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems
 - 2. D448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - 3. D1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics
 - 4. D1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 5. D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 - 6. D2564: Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
 - 7. D2729: Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 8. D3034: Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 9. D4716: Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
 - 10. F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 11. F656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 - 12. F1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings

D. Caltrans Standard Specifications, 2015

1. Section 68-Subsurface Drains
2. Section 96-Geosynthetics

1.4 DEFINITIONS

A. AASHTO: American Association of State Highway and Transportation Officials

B. ASTM: American Society for Testing and Materials

C. PVC: Polyvinyl Chloride

1.5 SUBMITTALS

A. Follow submittal procedure in accordance with Section 01 10 00, Supplemental General Requirements.

B. Product data for the following:

1. Perforated pipe and fittings
2. Solid pipe and fittings
3. Prefabricated composite drainage panels
4. Geotextile fabrics
5. Cleanout plugs or caps
6. Precast clean out boxes and box covers
7. Drainage bubblers
8. Biofiltration soil material

C. Samples:

1. Drainage Fill

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe-fittings, and seals from dirt and damage.

C. Protect permeable material from contamination by other materials.

PART 2 PRODUCTS

2.1 PERFORATED WALL AND SOLID WALL PIPE

A. PVC pipe and Fittings Smaller than 4-inch:

1. Pipe: ASTM D1785, Schedule 40. Solvent cement joints
2. Solvent Cement: ASTM D2564. Include primer according to ASTM F656.
3. Perforation Size, Location, and Spacing: ASTM D2729

B. PVC Pipe and Fittings 4-inch through 15-inch:

1. Pipe: ASTM D3034, SDR 26. Bell and spigot joints
2. Perforation Size, Location, and Spacing: ASTM D2729
3. Fittings: ASTM F1336
4. Joint Gasket: Elastomeric seal, ASTM F477

2.2 SPECIAL PIPE COUPLINGS

- A. Description: ASTM C1173. Rubber or elastomeric sleeve and stainless steel band assembly fabricated to match outside diameters of pipes to be joined.

2.3 CLEANOUTS

- A. Piping: Same as subdrain pipe without perforations.
- B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.
 1. Size box to provide access and allow easy removal and reinstallation of plug or cap.
 2. Types:
 - a. Non-Traffic Areas: Portland cement concrete box and box cover, light duty.
 - b. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading.
- C. Cover Markings: "STORM DRAIN" unless otherwise specified.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - a. Associated Concrete Products, Inc.,
 - b. Brooks Products Inc.,
 - c. Christy Concrete Products, Inc., or approved equal

2.4 PREFABRICATED COMPOSITE DRAINAGE PANELS

- A. Description: Prefabricated composite panels, 36 to 60 inches wide and manufactured with geotextile facing laminated to molded drainage core
- B. Drainage Core: Three-dimensional, non-biodegradable, molded Polypropylene or Polystyrene
 1. Minimum Compressive Strength: 10,000-lbf./sq. ft. when tested according to ASTM D1621
 2. Minimum Flow Rate: 2.8 gpm per foot at hydraulic gradient of 0.05 and compressive stress of 25 psig when tested according to ASTM D4716
- C. Geotextile: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M288
 1. Survivability Class: 1
 2. Apparent Opening Size: No. 70 sieve maximum
 3. Permittivity: 0.5 per second, minimum

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:

1. American Wick Drain Corporation
2. Tencate Geosynthetics/Mirafi Inc.
3. Multi-Flow (Prinsburg, MN) (Tel. 800-978-8007)
4. Phillips Fibers Corporation, or approved equal

2.5 BIORETENTION OR BIOFILTRATION TREATMENT SOIL

A. Soil specification shall meet requirements of local agency having authority or sustainability requirements for projects achieving environmental goals.

1. For projects located within the jurisdiction of the Municipal Regional Stormwater Permit (MRP), treatment soil shall conform to requirements in Appendix L of the MRP. Contractor shall provide submittal information verifying conformance to MRP standard.

2.6 DRAINAGE FILL MATERIAL

A. Permeable Material: Conform to Section 68-2.02F(3) of Caltrans Standard Specifications, Class 2.

B. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Sieve No. 57, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 8 sieve

2.7 GEOSYNTHETICS

A. When required, use filter fabric for encasing permeable material around subdrains.

1. Caltrans Filter Fabric: Section 96-1.02B of Caltrans Standard Specifications,
2. Mirafi 140N (by Tencate Geosynthetics/Mirafi Inc.), or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Install only after unsatisfactory conditions have been corrected.

3.2 PIPING APPLICATIONS

A. Refer to Plans for location, size, and material designation for individual subdrains.

3.3 INSTALLATION OF PERFORATED PORTIONS OF SUBDRAINS

A. Excavation: Section 6 of ASTM D2321 and as indicated.

B. Subdrain Bedding: Place supporting layer of drainage fill over compacted subgrade to compacted depth indicated. If drainage fill requires encasement in filter fabric, lay filter fabric in trench and overlap trench sides before installing drainage fill.

- C. Piping Installation: Install pipe in accordance with Section 7 of ASTM D2321. Install piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Excavate recesses for bottoms of bell ends of pipe. Lay pipe with bells facing upslope and with spigot end centered fully into adjacent bell. Bed piping with full pipe bearing in drainage fill material. Lay perforated pipe with perforations down. Install gaskets, seals, sleeves, and couplings in accordance with manufacturers written instructions. Use increasers, reducers, and couplings made for different sizes of materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- D. Initial Subdrain Backfill: After installing drainage piping, add drainage fill up to top of pipe to perform tests.
- E. Testing Subdrain: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling with drainage fill. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- F. Subsequent Subdrain Backfill: After satisfactory testing, cover piping with drainage fill to width and height indicated. Place drainage fill in layers not exceeding 3 inches in loose depth; compact each layer placed. If filter fabric is required complete the filter fabric encasement by bringing fabric to top and closing the encasement.
- G. Fill to Grade: Place native fill material over compacted drainage fill to thickness indicated. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish elevations.

3.4 INSTALLATION OF NON-PERFORATED PORTIONS OF SUBDRAINS

- A. Conform to Sections 31 23 33, Utility Trenching and Backfill and 33 41 00, Storm Utility Drainage Pipe.

3.5 INSTALLATION OF RAIN GARDENS, BIORETENTION OR BIOFILTRATION TREATMENT AREAS

- A. The Contractor shall excavate rain gardens / treatment areas to the elevations and dimensions specified on the plans. Level surface of area of top of treatment soil shown on the plans shall govern actual length and width dimensions if shown on the plans. In-situ soils shall not be further compacted.
- B. Direct the use of heavy equipment and construction traffic around rain gardens so as to avoid compaction, to the extent possible.
- C. After initial site grading, the Contractor shall provide temporary protection from curb cuts and other potential inflow entrances so that runoff drainage does not enter the rain gardens during construction and installation.
 - 1. Treatment areas / rain gardens may be used as sediment settling facilities during mass excavation and commensurate construction activities.
 - 2. Prior to commencing work in rain gardens, the Contractor shall remove and properly dispose of all accumulated sediments.
- D. Excavated soils shall be placed with stockpiled fill and properly disposed and stabilized by the Contractor.

E. Subdrain installation:

1. Subdrain shall be installed as indicated on the plans at an elevation within the drain rock layer shown on the construction details and connected to the overflow or outfall structure at the invert elevation shown on the plans.
2. For connections of the perforated drain pipes to storm drainage structures, appropriately sized holes shall be cut in the structures at the correct invert elevation specified by the Project Designer or authorized representative. The connections shall be sealed sediment-tight and secured in place with mortar or other approved joint sealant compatible with subdrain pipe materials.
3. Drain rock layer shall be approved Class II Permeable Material. Crushed rock or aggregate base cannot be used within the treatment area, in, around or under the drain rock layer.
4. Care shall be exercised to prevent natural or fill soils from intermixing with the drain rock surrounding the underdrain. All contaminated drain rock shall be removed and replaced with uncontaminated Class II permeable material.
5. Attach subdrain piping to overflow structure.
6. Install cleanouts at the ends of the subdrains. Install screw-on end caps set flush with the finished top of treatment soil.

F. Overflow drain structure:

1. Install overflow structure at the elevation and location specified on the plans. Attach subdrain piping to overflow structure. Attach solid pipe from overflow structure outfall storm drain system at elevation and slope indicated on the plans.
2. Rim elevation of overflow structure must be set above the elevation of the top of treatment soil by the amount indicated on the plans, typically 6 inches. Contractor shall verify that the rim elevation of the overflow structure is also a minimum of 2 inches below the lowest elevation of the treatment area perimeter so that storm flows will reach the overflow rim before the top of the treatment area perimeter.
3. The overflow structure shall have an open bottom filled with drain rock if indicated on the plans. This should be installed where the overflow structure has a sump condition (subdrains lower than the outfall invert elevation). The overflow structure shall be installed such that the bottom of the structure is set a minimum of 6-inches below the undisturbed bottom of the treatment area. Drain rock in the overflow sump shall be installed up to the invert of the lowest pipe connected to the structure.

G. Filter media soil backfill

1. Filter soil of the approved specification shall be installed to the elevation indicated on the plans. Care should be taken to ensure that the soil is not compacted and that no equipment is driven on the backfill. Walking on the backfill should be limited to what is absolutely necessary.

H. Planting soil, plantings, and mulch shall be installed per the plans. Non-floating bark / mulch shall be used, if indicated, to prevent removal of material and clogging of the overflow.

I. Testing of the treatment area should be conducted once the filter media is installed and all storm drain piping is connected. The area should allow an infiltration rate well above 5 inches/ hour to ensure that the treatment area will continue to function at 5 inches/ hour over the lifetime of the treatment area.

3.6 PREFABRICATED COMPOSITE DRAINAGE PANELS

- A. Coordinate placement with other drainage materials.
- B. Install prefabricated drainage panels in accordance with manufacturer's instructions.
- C. Place perforated drainage pipe at base of footing and attach to composite drainage panels in accordance with the manufacturer's instructions.

3.7 JOINING PIPE

- A. Join PVC pipe and fittings with elastomeric seals according to ASTM D2321 or solvent cement.
- B. Special pipe couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.8 CLEANOUT INSTALLATION

- A. Cleanout piping to be the same size as the subdrain piping to which it is attached.
- B. Install cleanouts from subdrainage piping to grade. Locate cleanouts at beginning of piping run, at changes in direction, and other locations indicated.
- C. Do not allow cleanout box to bear on cleanout riser.

3.9 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

3.10 RETAINING WALL DRAINAGE

- A. Unless otherwise specified, drain system should consist of a minimum of 12 inches thick free-draining granular materials containing less than five percent fines passing a No. 200 sieve placed adjacent to the wall. Free-draining granular material should be graded to prevent the intrusion of fines or encapsulated in a suitable filter fabric. As an alternative, a prefabricated drainage structure, such as geo-composite, or approved equivalent, may be used as a substitute for the granular backfill adjacent to the wall.
- B. Drainage system consisting of either weep holes or perforated drain lines (minimum 4 inch diameter placed near the base of the wall) should be used to intercept and discharge water which would tend to saturate the backfill. Where used, drain lines should be embedded in a uniformly graded filter material and provided with adequate clean-outs for periodic maintenance.
- C. An impervious soil should be used in the upper one foot layer of backfill to reduce the potential for water infiltration.

END OF SECTION

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