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PROCUREMENT AND CONTRACTING REQUIREMENTS

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END OF SECTION 000110

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 PROJECT INFORMATION

A. Project Name: Buena HS Track and Field Replacement

B. Owner's Name: Ventura Unified School District

C. Architect's Name: LPA Inc.

D. The Project consists of the construction of removal and reconstruction of track surfacing and synthetic turf field, associated sports elements, and miscellaneous hardscape and softscape associated with the stadium entry..

1.02 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
   1. California Mass Agreement System (CMAS)

1.03 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Nonsmoking Building: Smoking is not permitted within buildings or 25 feet of entrances, operable windows, outdoor-air intakes.

D. Controlled Substances: Use of tobacco products and other controlled substances within the exisitng building is not permitted.

1.05 WORK SEQUENCE

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 011000

SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Price and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 DEFINITIONS

A. Minor Change in the Work: A change which does not affect the Contract Sum or Contract Time.

1.03 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Project record documents.

1.04 SCHEDULE OF VALUES

A. Use Schedule of Values Form: As stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

E. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

F. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

G. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization and bonds and insurance.

H. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

I. Revise schedule to list approved Change Orders, with each Application For Payment.

1.05 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. For each item, provide a column for listing each of the following:

1. Item Number.
2. Description of work.
3. Scheduled Values.
4. Previous Applications.
5. Work in Place and Stored Materials under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

E. Execute certification by signature of authorized officer.

F. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

H. Submit three notarized copies of each Application for Payment.

I. Include the following with the application:
1. Transmittal letter as specified for submittals in Section 013000.
2. Construction progress schedule, revised and current as specified in Section 013000.
3. Partial release of liens from major subcontractors and vendors.

J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.06 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change . Contractor shall prepare and submit a fixed price quotation within 15 working days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.

4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

F. Substantiation of Costs: Provide full information required for evaluation.
1. Provide the following data:
a. Quantities of products, labor, and equipment.
b. Taxes, insurance, and bonds.
c. Overhead and profit.
d. Justification for any change in Contract Time.
e. Credit for deletions from Contract, similarly documented.
2. Support each claim for additional costs with additional information:
a. Origin and date of claim.
b. Dates and times work was performed, and by whom.
c. Time records and wage rates paid.
d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

J. Promptly enter changes in Project Record Documents.

1.07 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 017000.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Waivers.
5. Consent of Surety to final payment.
6. Evidence that claims have been settled.
7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
8. Final liquidated damages settlement statement.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012000

SECTION 012500.01

SUBSTITUTION REQUEST FORM

Project Name:	Job No.: Date:
To: Architect: LPA, Inc.	Contractor:
Specified Item:	

Specification Section	Paragraph No.	Drawing No.	Detail No.

Contractors Proposed Substitution:

Reason for Request: _____

_____

Manufacturer: _____

Manufacturer Contract: _____

Trade Name and Model: _____

History: ☐ New Product ☐ 1-4 Years in market ☐ 5-10 years in Market ☐ Over 11 years in market

Mandatory for Consideration: Specification Section 012500 – Substitution Procedures

☐ Drawings ☐ Product Data ☐ Samples ☐ Test Data ☐ Reports ☐Other _____

Attach a **Point by Point Comparison** between proposed product and product indicated. Provide complete data for proposed product, including product/material descriptions, specifications, drawings, photographs, performance, MSDS data sheet and test data adequate for evaluation of the request. Clearly annotate applicable portions of the data. Include ICC Evaluation Service (ICC ES) Evaluation Report, if applicable.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equivalent or superior in all respects to specified product.
- Proposed substitution complies with applicable Codes, ordinances and standards.
- Proposed substitution complies with Contract requirements.
- Same warranty will be furnished for proposed substitution as specified products.
- Same maintenance service and source of replacement parts, as applicable, are available.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs cause by the substitution.

Submitted by: (name) _____ Title: _____

Signed: _____ Date: _____

SUBSTITUTION REQUEST

Architect's Recommended Action:

☐ **Approved.** Refer to the change document noted under Remarks below.

☐ **Rejected – Use specified product/material.**

Name: _____ Date: _____

Remarks: _____

_____

_____

_____

_____

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 012500.01 - Substitution Request Form: Required form for substitution requests.

B. Section 013000 - Administrative Requirements: Submittal procedures, coordination.

C. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

D. Section 016116 - Volatile Organic Compound (VOC) Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
   6. Will obtain necessary approval of agencies having jurisdiction.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms included in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:
   1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

B. Submittal Form (before award of contract):
   1. Submit substitution requests by completing the form attached to this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Should a Contractor-proposed substitution or alternative sequence or method of construction require revision of the Contract Drawings or Specifications, including revisions for the purposes of determining feasibility, scope or cost, or revisions for the purpose of obtaining review and approval by authorities having jurisdiction, revisions will be made by Architect or other consultant of the District who is the responsible design professional, as approved in advance by District's Representative.

B. Services of Architect, other responsible design professionals and District for researching and reporting on proposed substitutions or alternative sequence and method of construction shall be paid by Contractor when such activities are considered additional services to the design services contracts of Architect or other responsible design professional with District.

C. Costs of services by Architect, other responsible design professionals and District shall be paid, including travel, reproduction, long distance telephone and shipping costs reimbursable at cost plus usual and customary mark-up for handling and billing. Such fees shall be paid whether or not the proposed substitution or alternative sequence or method of construction is ultimately accepted by District and a Change Order is executed.

D. Such fees shall be paid from Contractor's portion of savings, if a net reduction in Contract Sum results. If fees exceed Contractor's portion of net reduction, Contractor shall pay all remaining fees unless otherwise agreed in advance by District's Representative.

E. Submittal Form (after award of contract):
   1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

F. Architect will consider requests for substitutions only within 15 days after date of Agreement.

G. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

H. Submit request for Substitution for Convenience within 14 days of discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval

by Architect, in order to stay on approved project schedule.

1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
3. Bear the costs engendered by proposed substitution of:
   a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

I. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

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

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION 012500

SECTION 013000.01

REQUEST FOR INTERPRETATION

Project Name:	Job No.: RFI No:
To: Architect: LPA, Inc.	Contractor:
Subject:	

Specification Section	Paragraph No.	Drawing No.	Detail No.

Category: ☐ Need for Clarification. ☐ Unforeseen Condition. ☐ Conflict Within Documents.	☐ Coordination Problem. ☐ Other.

Description:

Contractor's Proposed Resolution:

☐ Attachments:	
☐ Estimated Cost Impact" $	☐ Estimated Time Impact:
Contactor Signature:	Date:

Architect's Response:

Refer to RFI procedures specified in Section 013100 – Project Management and Coordination. This RFI, when completed is not

authorization for change to the Contract Documents. Changes to the Contract Documents are authorized only by properly executed Construction Change Directives or Change Order.
☐ Attachments:
Architect's Signature: Date:

SECTION 013000.02 – DIGITAL DATA REQUEST FORM

From (Requestor): _____ DRC NO.: _____ Date: _____

Project: _____

Project No: _____

Location: _____

Attn: _____ Description: _____

Phone: _____

Fax: _____

Execution of this document will confirm your request for copies of digital files related to the above referenced project. Please complete the following section and return a signed copy of this form via fax or mail with payment to LPA.

DESCRIPTION OF DOCUMENTATION REQUESTED:

Type of Files Needed:

_____ DWG (AutoCAD Native)

_____ DWF (AutoCAD Design Web)

_____ DXF (AutoCAD Drawing Exchange)

Purpose of Request: _____

If Requestor is a subcontractor to the Project's General Contractor, please indicate the name and phone number of contact at General Contractor's office:

Name: _____ Number: _____

If Requestor is a consultant to the project's owner, please indicate the name and phone number of contact at owner's office:

Name: _____ Number: _____

LPA can only release electronic files to the Project's Owner, consultants to the Project's Owner and/or the Project's General Contractor. A written statement by the Project's General Contractor authorizing LPA to release documentation to a subcontractor of the General Contractor must accompany this request. Please be advised that, in case of existing construction, the documents requested are reproductions of documentation on file and do not necessarily represent as-built or existing conditions. LPA does not warrant in any way the accuracy of this information and shall not be responsible for any discrepancy between this documentation and the existing conditions. In the case of projects which are currently being designed and/or under construction, the electronic documentation are reproductions of the documentation on file and may be subject to change due to owner, field and/or coordination revisions. LPA shall not be responsible for reissuing files which may me revised after issuance of these requested files and shall not be responsible for advising other parties as to the status of document revisions. Also, please be advised that the requested documents are instruments of service and, as such, remain the property of LPA and/or the respective consultant. Any unauthorized re-use of these documents without the written authorization of LPA and/or consultant is strictly prohibited. Please note all disclaimers and warnings printed on electronic media labels. Electronic media may contain undetected viruses. It is always recommended that disks be checked prior to use. LPA assumes no liability or responsibility for damage to user's property as a result of using this request may include archive storage and retrieval, charges, reproduction and handling expenses, etc., which are estimated to be, but may exceed $0.00. The exact cost will be determined by LPA upon execution of this request confirmation

The basic charge for copying/translating DWG (AUTOCAD), DWF or DXF files is $100 per drawing.

_____ Payment of these costs must be made by the requestor to LPA, Inc. prior to release of the documents.

_____ The requested files shall be provided at the direction of the Owner. No charge to Requestor.

By signing this Request, the Requestor agrees to the conditions for reimbursement to LPA, Inc. as stated above.

Authorized Signature: _____ Date:_____

Please return one fully executed copy of this form to: LPA, Inc.
(Offices in Irvine, San Diego, San Jose, & Sacramento, CA and San Antonio, TX)

SECTION 013000.03

SUBMITTAL COVER SHEET

Project Name: **LPA, Inc. Project No.:**	**Resubmittal** ☐ **Yes** **Add "letter" to original number**	**Submittal No:**
SUBCONTRACTOR: **Name:** **Address:** **Phone:** **Contact:**	**CONTRACTOR:** **Name:** **Signed:** **Dates:** **I hereby certify that I have reviewed the attached, have verified requirements and compliance with the Contract Documents.**	
Submittal Description:	**Specification Section:**	
Date Received From Contractor:	**Specification Section:**	
Consultant Review: ☐ **Civil** ☐ **Electrical** ☐ **Mechanical** ☐ **Structural** ☐ **Other:** _____ **Date sent to consultant:** _____ **Date received from consultant:** _____	**Copies:** ☐ **Contractor** ☐ **Inspector** ☐ **LPA File** ☐ **Owner** ☐ **Other:** _____	

Review and commentary noted below are only for general conformance with (1) The design concept of the project and (2) The information given in the contract documents and for no other purpose. Commentary below is subject to the requirements of the contract documents. The contractor is not relieved from responsibility for any deviation from the requirements of the contract documents, errors or omissions in drawings, calculations or samples, confirmation and correlation of dimensions at the job site, fabrication process and techniques of construction, coordination of his work with that of all other trades and satisfactory performance of his work.

☐ **Reviewed** ☐ **Furnish as corrected** ☐ **Revise and Resubmit**	☐ **Contractor** ☐ **Inspector**
Reviewed by:	**Date:**

Remarks:	

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Web-based project software service.
C. Electronic document submittal service.
D. Site mobilization meeting.
E. Project closeout conference.
F. Construction progress schedule.
G. Contractor's daily reports.
H. Progress photographs.
I. Coordination drawings.
J. Requests for Interpretation (RFI).
K. Submittal procedures.
L. Delegated design.

1.02 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: General product requirements.
B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements and preinstallation meetings.
C. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Manufacturer's instructions and field reports.
   6. Applications for payment and change order requests.
   7. Progress schedules.
   8. Coordination drawings.
   9. Correction Punch List and Final Correction Punch List for Substantial Completion.
   10. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WEB-BASED PROJECT SOFTWARE SERVICE

A. Web-Based Project Software Service: Provide, administer, and use web-based project software to host and manage project communication and documentation.
   1. Include, at minimum, the following features:
      a. Project directory, including Owner, Contractor, subcontractors, Architect, Architect's consultants, and other entities involved in the project. Include names of contact persons and contact information for each entity.
      b. Access control for each entity and for each workflow process to determine each entity's digital rights to create, modify, view, and print documents.
      c. Workflow planning, allowing customization of workflow for each project entity.
      d. Creation, logging, tracking, and notification for project communications.
      e. Tracking of project communication statuses in real time, including timestamped response log.
      f. Procedures for viewing PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
      g. Processing and tracking of payment applications.
      h. Processing and tracking of contract modifications.
      i. Creation and distribution of meeting minutes.
      j. Document management for drawings, specifications, and coordination drawings, including revision control.
      k. Management of construction progress photographs.
      l. Mobile device compatibility.
      m. Creation of data analytics reports.
      n. Creation and export of editable logs for software functions. Provide Owner, Architect, and Architect's consultants with rights and ability to download logs when requested.
   2. Cost: Pay cost of service. Include the cost of the service in the contract sum.
   3. Provide up to 20 user licenses for use by Owner, Architect, Architect's consultants, and other entities involved in the project.
   4. Comply with the software service's current published licensing agreements.
   5. Training: Provide one-hour, web-based training session for users of software service. Further training is the responsibility of the user.
      a. Representatives of Owner are scheduled and included in this training.
   6. Project Closeout: Architect determines when to terminate the software service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment,

field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.

2. Contractor and Architect are required to use this service.
3. It is Contractor's responsibility to submit documents in allowable format.
4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.03 SITE MOBILIZATION MEETING

A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
1. Contractor.
2. Owner.
3. Contractor's superintendent.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Work restrictions.
4. Work hours.
5. Construction facilities and controls provided by Owner.
6. Temporary utilities provided by Owner.
7. Survey and building layout.
8. Procedures for moisture and mold control.
9. Procedures for disruptions and shutdowns.
10. Construction waste management and recycling.
11. Parking availability.
12. Office, work, and storage areas.
13. Equipment deliveries and priorities.
14. First aid.
15. Security and housekeeping procedures.
16. Schedules.
17. Application for payment procedures.
18. Procedures for testing.
19. Procedures for maintaining record documents.
20. Requirements for start-up of equipment.

21. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 **PROJECT CLOSEOUT CONFERENCE**

A. Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Owner's Commissioing Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
      a. Preparation of record documents.
      b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
      c. Submittal of written warranties.
      d. Coordination of separate contracts.
      e. Owner's partial occupancy requirements.
      f. Installation of Owner's furniture, fixtures, and equipment.
      g. Responsibility for removing temporary facilities and controls.
   4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

3.05 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 013216

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.06 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
   1. Date.
   2. High and low temperatures, and general weather conditions.
   3. List of subcontractors at Project site.
   4. Major equipment at Project site.
   5. Material deliveries.
   6. Safety, environmental, or industrial relations incidents.

7. Meetings and significant decisions.
8. Unusual events (submit a separate special report).
9. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
10. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
11. Change Orders received and implemented.
12. Testing and/or inspections performed.
13. List of verbal instruction given by Owner and/or Architect.
14. Signature of Contractor's authorized representative.

3.07 PROGRESS PHOTOGRAPHS

A. Submit new photographs at least once a month, within 3 days after being taken.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

D. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Excavations in progress.
   3. Foundations in progress and upon completion.
   4. Structural framing in progress and upon completion.
   5. Mock-ups.
      a. Take photographs of all mock-ups required for Project scope.
      b. Take photographs of materials and assemblies that are both accepted and rejected by Owner and Architect.
   6. Teating and inspections.
      a. Take photographs of materials and assemblies which require testing and inspections.
      b. Pay special attention to items that will be concealed during further construction operations.
   7. Concealed Work.
      a. Before proceeding with installing Work that will conceal other Work, take photographs in sufficient number, with annotated descriptions, to record the nature and location of concealed Work. Including, but not limited to:
         1) Underslab utilities.
         2) Underslab services.
         3) Piping.
         4) Electrical conduit.
         5) Below-grade waterproofing.
         6) Weather barrier membranes.
         7) Roofing components.
   8. Fabrication, at locations away from Project site.

E. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Uploaded to Project web site..
   2. File Naming: Include project identification, date and time of view, and view identification.

3.08 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

3.09 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare using an electronic version of the form appended to this section.
   3. Prepare using software provided by the Electronic Document Submittal Service.
   4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 016000 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
      a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date.

5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.
5. Identify and include improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

1.02 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 013216 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

1.03 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data. Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
   2. Shop drawings. Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
   3. Samples: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
      a. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
         1) Samples for selection.
         2) Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

1.04 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Sustainability design submittals and reports.
   3. Certificates.
   4. Test reports.
   5. Inspection reports.
   6. Manufacturer's instructions.
   7. Manufacturer's field reports.
   8. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

1.05 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

1.06 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Extra Copies at Project Closeout: See Section 017800.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

1.07 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
      a. Send submittals in electronic format via email to Architect.
   6. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
      c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
   7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   8. Provide space for Contractor and Architect review stamps.
   9. When revised for resubmission, identify all changes made since previous submission.
   10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
   11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Submit concurrently with related shop drawing submittal.
   4. Do not submit (Material) Safety Data Sheets for materials or products.
   5. Submit sustainable design reporting submittals under separate cover.

C. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.

3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

E. Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

F. Submittal number or other unique identifier, including revision identifier.
1. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

G. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

H. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

1.08 SUBMITTAL REVIEW

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

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Reviewed", or language with same legal meaning.
1) No corrections noted.
b. "Make Corrections Noted", or language with same legal meaning.
1) Incorporate review notations, resubmission not required.
2. Not Authorizing purchasing, fabrication, delivery, and installation:
a. "Revise and Resubmit", or language with same legal meaning.
1) Submittal is incomplete and / or needs corrections.

2) Resubmit, with all required components and with review notations acknowledged and incorporated.
3) Non-responsive resubmittals may be rejected.

b. "Submit Specified Item", or language with same legal meaning.
1) Provide new submittal with item specified in Project Manual or drawings.
2) Substitutions not permitted.

c. "Rejected", or language with same legal meaning.
1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
a. "Reviewed" - no further action is required from Contractor.

1.09 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM Incorporation: Incorporate delegated design drawings and data files into BIM establlished for Project.

END OF SECTION 013000

SECTION 013216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

1.02 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.03 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Within 10 days after date of Agreement, submit preliminary schedule.

C. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

D. Within 20 days after review of preliminary schedule, submit draft of proposed complete Critical Path Method schedule for review.

E. Within 10 days after joint review, submit complete Critical Path Method schedule.

F. Submit updated schedule with each Application for Payment.

G. Submit in PDF format.

1.05 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.06 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Include conferences and meetings in schedule.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

F. Indicate delivery dates for owner-furnished products.

G. Coordinate content with schedule of values specified in Section 012000 - Price and Payment Procedures.

H. Provide legend for symbols and abbreviations used.

3.03 PRELIMINARY SCHEDULE BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 CONTRACTOR'S CRITICAL PATH METHOD (CPM) CONSTRUCTION SCHEDULE

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method (CPM).

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. Listing of activities on the critical path.

3.05 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.06 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.07 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 013216

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.

1.03 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.

1.04 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
   1. Design Services Types Required:
      a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
      b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.
C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

D. Experienced: When used with an entity or individual, "experienced", unless otherwise further described, means:
   1. Having successfully completed a minimum of five previous projects similar in nature, size, and extent of this Project.
   2. Bring familiar with special requirements indicated.
   3. Having complied with requirements of authorities having jurisdiction.

E. Mock-ups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
   1. Mockups are used for one or more of the following:
      a. Verify selections made under Sample submittals.
      b. Demonstrate aesthetic effects.
      c. Demonstrate the qualities of products and workmanship.
      d. Demonstrate successful installation of interfaces between components and systems.
      e. Perform preconstruction testing to determine system performance.

F. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

G. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. Temporary foundation underpinning.
   6. Temporary stairs or steps required for construction access only.
   7. Temporary hoist(s) and rigging.
   8. Investigation of soil conditions to support construction equipment.

1.06 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.
   1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.

1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
    a. Full name.
    b. Professional licensure information.
    c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
2. Include required product data and shop drawings.
3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Mock-up Shop Drawings:
1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

E. Contractor's Quality Control (CQC) Plan.

F. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
1. Include:
    a. Date issued.
    b. Project title and number.
    c. Name of inspector.
    d. Date and time of sampling or inspection.
    e. Identification of product and specifications section.
    f. Location in the Project.
    g. Type of test/inspection.
    h. Date of test/inspection.
    i. Results of test/inspection.
    j. Compliance with Contract Documents.
    k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

G. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

H. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

I. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
   1. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

C. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
   1. Requirements of Authorities Having Jurisdiction supersede requirements for specialists.

D. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

E. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.09 CONTRACTOR'S QUALITY CONTROL (CQC) PLAN

A. Contractor's Quality Control (CQC) Plan:
   1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
      a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
         1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
      b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
         1) Management and control of documents and records relating to quality.
         2) Communications.
         3) Coordination procedures.
         4) Resource management.
         5) Process control.
         6) Inspection and testing procedures and scheduling.
         7) Control of noncomplying work.
         8) Tracking deficiencies from identification, through acceptable corrective action, and verification.

9) Control of testing and measuring equipment.
10) Project materials certification.
11) Managerial continuity and flexibility.

c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.

d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

B. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.10 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.11 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.12 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

6. Retesting and reinspecting corrected Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

J. Where possible salvage and recycle the demolished mock-up materials.

3.03 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor's Responsibilities:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
      e. When testing is complete, remove test specimens. Do not reuse on Project.
   2. Testing Agency's Responsibilities:
      a. Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor.
      b. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

3.04 TOLERANCES

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

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.05 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.06 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.07 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION 014000

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering

B. Temporary Controls: Barriers, enclosures, and fencing.

C. Temporary facility use.

1.02 RELATED REQUIREMENTS

A. Section 015100 - Temporary Utilities.

B. Section 015213 - Field Offices and Sheds.

C. Section 015500 - Vehicular Access and Parking.

D. Section 015813 - Temporary Project Signage.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

D. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.04 DEWATERING

A. Provide temporary means and methods for dewatering all temporary facilities and controls.

B. Maintain temporary facilities in operable condition.

C. Maintain temporary facilities as directed by Architect.

1.05 TEMPORARY BARRIERS AND ENCLOSURES, GENERAL

A. Accessible Temporary Egress: Comply with applicable provisions in ADA Standards and ICC A117.1.

B. Materials: Refer to Part 2 of this Section.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular gates with locks.

1.08 TEMPORARY EXTERIOR ENCLOSURES

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

1.09 TEMPORARY INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.10 TEMPORARY FACILITY USE

A. Temporary Use of New Elevators:

B. Temporary Use of Existing Elevators: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner.
   1. Do not load elevators beyond their rated weight capacity.
   2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
   3. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

C. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

D. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

E. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, and with 1-5/8-inch OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; with galvanized-steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide concrete bases for supporting posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.

E. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

F. Temporary Enclosure Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

PART 3 EXECUTION - NOT USED

END OF SECTION 015000

SECTION 015639
TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Tree protection of existing trees and plants

B. Tree pruning of existing trees

1.02 RELATED REQUIREMENTS

A. Section 015000 - Temporary Facilities and Controls.

B. Section 311000 - Site Clearing.

C. Section 329300 - Landscape Work.

1.03 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at 6 inches (150 mm) above the ground for trees up to, and including, 4-inch (100-mm) size; and 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 SUBMITTALS

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

B. Samples for Verification: For each type of the following:
   1. Organic Mulch: 1-pint (0.5-L) 1-quart (1-L) volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
   2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
   3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
   1. Species and size of tree.
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning.
   4. Description of pruning to be performed.
   5. Description of maintenance following pruning.

D. Qualification Data: For qualified arborist and tree service firm.

E. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated

and repaired when damaged.

F. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

G. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.05 QUALITY ASSURANCE

A. Arborist Qualifications:
   1. Certified Arborist as certified by ISA.
   2. Licensed Arborist in jurisdiction where Project is located.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
      a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
      b. Enforcing requirements for protection zones.
      c. Arborist's responsibilities.
      d. Contractor responsibilities
      e. Field quality control.

1.06 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or trenching or digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
   8. Do not direct vehicle or equipment exhaust toward protection zones.
   9. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; 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 1 inch (25 mm) Insert dimension in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.
2. Refer to Section 32 Landscape Work for material requirements.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Wood and bark chips.
2. Size Range: 1-1/2" inch minimum, 3" maximum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by Architect.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch (50-mm) opening, 0.148-inch- (3.76-mm-) diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- (60-mm-) OD line posts, and 2-7/8-inch- (73-mm-) OD corner and pull posts; with 1-5/8-inch- (42-mm-) OD top rails and 0.177-inch- (4.5-mm-) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
   a. Height: 6 feet (1.8 m).
   b. Galvanized
   c. Polymer-Coating Color: Black.
2. Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches (914 mm) .

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size: as required
2. Text: "TREE PROTECTION ZONE - KEEP OUT. No unauthorized entry. No storage of vehicles, materials, or debris. No dumping of chemicals, slurry, paint, oil, etc. "
3. Lettering: 3-inch (75-mm-)high minimum, black characters on white background.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.02 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag - Tie a 1-inch (25-mm) blue-vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.

1. Apply 3-inch (76-mm) average thickness of organic mulch. Do not place mulch within 6 inches (152 mm) of tree trunks.

3.03 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
   2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
   3. Access Gates: Install as required; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet (10.5 m) on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
   2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.04 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only roots smaller than 2” in diameter that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and

covered with soil.

3.05 ROOT PRUNING

A. Do Not prune any roots without written authorization from Arborist or Client.

B. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
   1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
   2. Cut Ends: Do not paint cut root ends. Coat cut ends of roots more than 1-1/2 inches (38 mm) in diameter with emulsified asphalt or other coating formulated for use on damaged plant tissues as approved by the arborist.
   3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   4. Cover exposed roots with burlap and water regularly.
   5. Backfill as soon as possible according to requirements in Division 31 Section "Grading"

C. Root Pruning at Edge of Protection Zone: Prune roots 12 inches (300 mm) outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

D. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.06 CROWN PRUNING

A. Do not prune any branches without written authorization from Arborist or Client.

B. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
   1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
   2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:
      a. Type of Pruning: Cleaning Thinning Raising Reduction.
   3. Cut branches with sharp pruning instruments; do not break or chop.
   4. Do not apply pruning paint to wounds.

C. Chip removed branches and dispose of off-site.

3.07 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 4 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.08 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.09 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
   1. Submit details of proposed root cutting and tree and shrub repairs.
   2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
   3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
   4. Perform repairs within 24 hours.
   5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 66 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
   1. Provide new trees of same size and species as those being replaced for each tree that measures 4 inches (100 mm) or smaller in caliper size.
   2. Provide one new tree(s) of 6-inch (150-mm) caliper size for each tree being replaced that measure more than 4 inches (100 mm) in caliper size.
      a. Species: Species selected by Architect.
   3. Plant and maintain new trees as specified in Division 32 Section "Landscape Work"

C. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) O.C. Backfill holes with an equal mix of native soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 015713
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

B. Section 311000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.

C. Section 312200 - Grading: Temporary and permanent grade changes for erosion control.

D. Section 321123 - Aggregate Base Courses: Temporary and permanent roadways.

1.03 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus; 2021.

B. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2022.

C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015 (Reapproved 2023).

D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a (Reapproved 2023).

E. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile; 2021a.

F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017 (Reapproved 2021).

G. California State Water Resources Control Board, Construction General Permit; current edition.

H. California Stormwater Quality Association (CASQA), California Stormwater Best Management Practice (BMP) Handbook; current edition.

I. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

J. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2015.

1.04 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of _____ for erosion and sedimentation control .

B. Best Management Practices Standard: CASQA Stormwater BMP Handbook.

C. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
   1. Owner will obtain permits and pay for securities required by authority having jurisdiction.
   2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.

D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

J. Open Water: Prevent standing water that could become stagnant.

K. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:

1. Submit within 2 weeks after Notice to Proceed.
2. Include:
   a. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
   b. Schedule of temporary preventive measures, in relation to ground disturbing activities.
   c. Other information required by law.
   d. Format required by law is acceptable, provided any additional information specified is also included.
3. Obtain the approval of the Plan by Owner.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

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

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:
   1. Straw or hay.
   2. Erosion control matting or netting.
   3. Polyethylene film, where specifically indicated only.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Bales: Air dry, rectangular straw bales.

D. Bale Stakes: One of the following, minimum 3 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
   2. Wood, 2 by 2 inches in cross section.

E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
   1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
   2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491/D4491M.
   3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
   4. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
   5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
   6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
   7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

F. Silt Fence Posts: One of the following, minimum 5 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.

G. Gravel: See Section 321123 for aggregate.

H. Concrete: See Section 033000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

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

3.03 MAINTENANCE

A. Inspect preventive measures as required by the Storm Water Pollution Pervention Plan (SWPPP).
B. Repair deficiencies immediately.
C. Clean out temporary sediment control structures _____ and relocate soil on site.
D. Place sediment in appropriate locations on site; do not remove from site.

3.04 CLEAN UP

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

END OF SECTION 015713

SECTION 015813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

B. Project informational signs.

1.02 REFERENCE STANDARDS

A. FHWA (SHS) - Standard Highway Signs and Markings; 2004, with Supplement (2012).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Design sign and structure to withstand 50 miles/hr wind velocity.

B. Finishes: Adequate to withstand weathering, fading, and chipping for duration of construction.

2.02 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, standard large sizes to minimize joints.

C. Rough Hardware: Galvanized.

2.03 PROJECT IDENTIFICATION SIGN

A. One sign, 48 sq ft area, bottom 6 feet above ground.

B. Content:
   1. Names and titles of authorities.
   2. Names and titles of Architect and Consultants.
   3. Name of Prime Contractor.

C. Graphic Design, Colors, Style of Lettering: Designated by Architect.

D. Lettering: Standard Alphabet Series C, as specified in FHWA (SHS).

2.04 PROJECT INFORMATIONAL SIGNS

A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot distance.

PART 3 EXECUTION

3.01 INSTALLATION

A. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

B. Install sign surface plumb and level, with butt joints. Anchor securely.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION 015813

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Sustainable design-related product requirements, including:
   1. Low-emitting products.
   2. Products with life-cycle assessment (LCA).
   3. Sustainable wood products.
   4. Regional products.
   5. Products with recycled content.
   6. Products with bio-based content.
   7. Rapidly-renewable products.

C. Re-use of existing products.

D. Transportation, handling, storage, and protection requirements.

E. Product option requirements.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases, and substitution limitations.

B. Section 014000 - Quality Requirements: Product quality monitoring.

C. Section 016116 - Volatile Organic Compound (VOC) Restrictions: Requirements for VOC-restricted product categories.

D. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 DEFINITIONS

A. Basis of Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "Basis of Design Product" including make or model number or other designation. Published attributes and characteristics of basis of design product establish salient characteristics of products.
   1. Evaluation of Comparable Products: In addition to the basis of design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis of design product also establish salient characteristics of products for purposes of evaluating comparable products.

B. Bio-Based Content: Of vegetable or animal origin, not including products made by killing the animal.

C. Biopreferred Products: Commercial or industrial products, other than food or feed, that are composed in whole, or in significant part, from:
   1. Biological products.
   2. Renewable agricultural materials, including plant, animal, and marine materials.
   3. Forestry materials.
   4. Biobased intermediate ingredients or feedstocks.

D. Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including successive stages of processing, transformation, manufacturing, and distribution.

E. Chain-of-Custody Certificates: Certificates signed by manufacturers and fabricators certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.

F. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
   1. Identification of basis of design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
   2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

G. Composite Wood and Agrifiber: Products made of wood particles and / or plant material pressed and bonded with adhesive or resin, including:
   1. Particleboard.
   2. Medium density fiberboard (MDF).
   3. Plywood.
   4. Oriented-strand board (OSB).
   5. Wheatboard.
   6. Strawboard.

H. Environmental Product Declaration (EPD): A certified report that quantifies and verifies the life cycle assessment of a product or material. There are 3 types of EPD's:
   1. Product-Specific, by 3rd Party: ISO 14044-compliant EPD, specific to a manufacturer and product, and prepared by an independent third party.
   2. Product-Specific, by Manufacturer: ISO 14071-compliant EPD, specific to a manufacturer and product, prepared by manufacturer. This type is preferred over 3rd party type.
   3. Industry-Wide (Generic), by 3rd Party: ISO 14025-compliant, and EN 15804 or ISO 21930, specific to a product type, including several manufacturers, and prepared by an independent third party. This type is the most preferred.

I. Health Product Declarations (HPD): A standard format for reporting product content and associated health information for building products and materials.

J. Manufacturer's Inventory of Product Content: Publicly available inventory of every ingredient identified by name and Chemical Abstract Service Registration Number (CAS RN).
   1. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.

K. Material Transparency: The practice by manufacturers of disclosing the environmental and health impacts of products.

L. Net Zero Carbon: The balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. We reach net zero when the amount we add is no more than the amount taken away.

M. Operational Carbon: as defined by Zero Carbon Standard 1.0, International Living Future Institute, is the Greenhouse Gas emissions associated with the operational energy use of a building. This

includes all carbon from energy required to heat and power the building, including but not limited to, lighting, plug loads, heating, cooling, and cooking.

N. Passive (As Related to MEP): Not part of the active portions of the Mechanical, Electrical, and Plumbing systems, for example piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, faucets, showerheads, and lamp housings.Product Category Rules: A set of rules, requirements, and guidelines for developing Environmental Product Declarations.

O. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

P. Rapidly Renewable Materials: Made from agricultural products that are typically harvested within a 10-year or shorter cycle.

Q. Recycled Content:
   1. Pre-Consumer Material: Diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
      a. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
      b. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.
   2. Post-Consumer Material: generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.

R. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a specified radius from the Project site.

S. Reused Products: Reclaimed or salvaged materials and equipment previously used in this or other construction, which extends the lifetime of materials that would otherwise be discarded.
   1. Wood fabricated from timber abandoned in transit after harvesting is considered reused.

1.04 REFERENCE STANDARDS

A. ASTM D6866 - Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis; 2024.

B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

C. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products; 2022 (Corrigendum 2021).

D. FSC STD-01-001 - FSC Principles and Criteria for Forest Stewardship; 1994.

E. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.

F. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines; 2006, with Amendment (2020).

G. ISO 21930 - Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services; 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

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

C. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Sustainable Product Data: Provide sustainable product documentation specified in this Section when required in other Sections, to validate sustainable properties of products.
   1. Documentation must be specific to products actually installed in the Project.
   2. Confirm that documentation contains certification labels for the companies and agencies providing certification.

E. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

F. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.06 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.07 PRODUCT WARRANTY REQUIREMENTS

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 3000 - Administrative Requirements.

PART 2 PRODUCTS

2.01 PRODUCTS, GENERAL

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged, and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected", Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.
   3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

D. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
   1. No available domestic product complies with the Contract Documents.
   2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.

2.02 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.03 NEW PRODUCTS, GENERAL

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

2.04 LOW-EMITTING PRODUCTS

A. Low-Emitting Products: Provide low-VOC-emitting products to meet Owner's sustainability goals for Project and as otherwise required by code.
   1. See Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions, for additional information.

B. VOC Restrictions Data: Provide manufacturer's data that verifies products are at or below acceptable thresholds of volatile content specified in Section 016116.
   1. Items in list below with (CDPH) indicate compliance with California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers" CAL (CDPH SM). See Section 016116 for additional information.
      a. Other 3rd party document specifically indicating compliance with standard is acceptable.
   2. Examples include, but are not limited to:
      a. Collaborative for High Performance Schools.
         1) Web: https://chps.net/ .
      b. Carpet and Rug Institute (CRI) Green Label Plus (CDPH).
         1) Web: https://carpet-rug.org/testing/green-label-plus/ .
      c. Cradle to Cradle Material Health Certificate.
         1) Web: https://c2ccertified.org/material-health-certificate .
      d. Declare.
         1) Web: https://living-future.org/declare/ .
      e. Emicode (flooring):
         1) Web: https://www.emicode.com/en/home/ .
      f. GreenScreen.
         1) Web: https://www.greenscreenchemicals.org/certified .
      g. Green Squared (tile products).
         1) Web: https://greensquaredcertified.ecomedes.com/ .
      h. Health Product Declaration (HPD).
         1) Web: https://www.hpd-collaborative.org/ .
      i. Intertek, Clean Air Gold certification (CDPH).
         1) Web: https://www.intertek.com/certification/indoor-air-quality/ .
      j. MAS, Certified Green certification (CDPH).
         1) Web: https://mascertifiedgreen.com/ .
      k. SCS Global Services / Resilient Floor Coverings Institute (RFCI), FloorScore (CDPH).
         1) Web: https://www.scsglobalservices.com/services/floorscore .
      l. SCS Global Services, Indoor Advantage.
         1) Web: https://www.scsglobalservices.com/services/indoor-air-quality-certification.
      m. UL Ecologo.
         1) Web: https://www.ul.com/resources/ecologo-certification-program .
      n. UL Greenguard (CDPH - Gold certification required).
         1) Web: https://www.ul.com/services/ul-greenguard-certification .

2.05 PRODUCTS WITH LIFE CYCLE ASSESSMENT (LCA)

A. Life Cycle Assessment: As specified and when possible, provide products with life cycle data.

B. Life Cycle Data: Provide documentation that verifies stages of a product's existence, including pre-consumer and post-consumer recycled content, as applies.
   1. Examples include, but are not limited to:
      a. Cradle to Cradle.
         1) Web: https://c2ccertified.org/ .
      b. Environmental Product Declaration (EPD).
         1) Web: https://www.environdec.com/home .
      c. UL Environmental Product Declaration.
         1) Web: https://www.ul.com/services/environmental-product-declaration-certification .

2.06 SUSTAINABLE WOOD PRODUCTS

A. Sustainable Wood Products: As specified and when possible, provide wood products that are both certified and are certified for chain-of-custody.

B. Certified Wood: Provide wood products that are certified and labeled by one of the following:
   1. Forest Stewardship Council (FSC), certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001 and FSC STD-40-004.
      a. Web: https://us.fsc.org/en-us/certification .
   2. Sustainable Forest Initiative (SFI), certified according to SFI 2022 Forest Management Standard.
      a. Web: https://forests.org/sfi-2022-standards/ .

C. Chain-of-Custody Data: Provide chain-of-custody documentation by one of the following:
   1. Forest Stewardship Council, Chain of Custody (FSC CoC).
      a. Web: https://us.fsc.org/en-us/certification/chain-of-custody-certification .
   2. Sustainable Forest Initiative, Chain-of-Custody Standard.
      a. Web: https://forests.org/chainofcustodystandard/ .

2.07 REGIONAL PRODUCTS

A. Regional Products: As specified and when possible, provide regional products.

B. Regional Material Data: Provide documentation that product has been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
   1. Source Location: Location of harvest, extraction, recovery, or manufacture; where information about source location is required to be submitted, give the postal address:
      a. In every case, indicate the location of final assembly.
      b. For harvested products, indicate location of harvest.
      c. For extracted (i.e. mined) products, indicate location of extraction.
      d. For recovered products, indicate location of recovery.
   2. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.

C. Acceptable Evidence:
   1. Manufacturer's certification.
   2. Life cycle analysis (LCA) performed by third-party.

2.08 PRODUCTS WITH RECYCLED CONTENT

A. Recycled Content: As specified and when possible, provide products with pre-consumer plus post-consumer recycled content with not less than the following:
   1. Aluminum: 75 percent.
   2. Cellulose: 75 percent.
   3. Cork: 100 percent.
   4. Fiberglass: 50 percent.
   5. Glass: 10 percent.
   6. Gypsum: 75 percent.
   7. Mineral Fiber: 50 percent.
   8. Polyester Fiber (PET / PETE / PETG): 50 percent.
   9. Rubberized Asphalt: 40 percent.
   10. Solid-Surfacing: 10 percent.
   11. Steel: 90 percent.
   12. Stone Wool: 40 percent.

2.09 PRODUCTS WITH BIO-BASED CONTENT

A. Product with Bio-Based Content: As specified and when possible, provide products with bio-based content, as determined by ASTM D6866, and sourced from a Sustainable Agriculture Network certified farm.
   1. Web: https://www.sustainableagriculture.eco/ .

B. Provide products that meet one of the following requirements:
   1. Materials that comply with the minimum biobased contents of the USDA's BioPreferred Program.
      a. Web: https://www.biopreferred.gov/BioPreferred/ .
   2. Materials that contain the USDA-certified Biobased Product label.
      a. Web: https://www.biopreferred.gov/BioPreferred/faces/pages/AboutLabel.xhtml .
   3. Materials composed of solid wood, engineered wood, bamboo, wool, cotton, cork, agricultural fibers, or other biobased materials with at least 50 percent bio-based content.
   4. Wood and wood products that contain not less than 60 percent wood content tracked by a chain-of-custody process and documented and certified in accordance with principles, standards, and criteria developed using ISO/IEC Guide 59 or the WTO Agreement on Technical Barriers to Trade.

2.10 RAPIDLY RENEWABLE PRODUCTS

A. Rapidly Renewable Products: As specified and when possible, provide rapidly renewable products made from materials with a harvest cycle of 10 years or fewer.

B. Accepable rapidly renewable materials include:
   1. Agrifibers.
   2. Bamboo.
   3. Cork.
   4. Cotton.
   5. Linseed.
   6. Natural rubber.
   7. Soy.
   8. Straw.
   9. Sunflower.
   10. Wheat.
   11. Wool.

2.11 PRODUCT OPTIONS

A. Product selection shall be done in accordance with the following requirements:
   1. Standards, Codes and Regulations: Select from among products that are in compliance with the project requirements, as well as with construction standards, all applicable codes and regulations and sustainable design requirements.
   2. Performance Requirements: Provide products that comply with specific performances indicated and are recommended by the manufacturer, in published product literature or by individual certification, for the application indicated.
   3. Prescriptive Requirements: Provide products that have been produced in accordance with prescriptive requirements, using specified ingredients and components and complying with specified requirements for mixing, fabricating, curing, finishing, testing and other operations in the manufacturing process.

B. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

C. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

D. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

E. Basis of Design Products: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers.
   1. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.

F. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

G. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500 - Substitution Procedures for proposal of product.

H. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

I. Products, which, by nature of their application, are likely to be needed at a later date for maintenance and repair or replacement work, shall be current models for which replacement parts are available.

2.12 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3000 - Administrative Requirements, for submittal procedures.
1. Form of Approval of Submittal: As specified in Section 01 3000 - Administrative Requirements.
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

2.13 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION, DELIVERY, AND HANDLING REQUIREMENTS

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

E. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

F. Deliver products in manufacturer's original sealed containers or other packaging system, complete with labels and instructions for handling, storage, unpacking, protection, and installing.
   1. Comply with manufacturer's warranty conditions, if any.

G. Transport and handle products in accordance with manufacturer's instructions.

H. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

I. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

J. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

K. Packaging Waste Management: See Section 01 7419 - Construction Waste Management and Disposal.
   1. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION REQUIREMENTS

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.
   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.
   1. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide off-site storage and protection when site does not permit on-site storage or protection.
   1. Execute a formal supplemental agreement between Owner and Contractor allowing off-site storage, for each occurrence.

I. Protect products in accordance with manufacturers' written instructions.

J. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

K. Comply with manufacturer's warranty conditions, if any.

L. Do not store products directly on the ground.

M. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

N. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

O. Protect liquids from freezing.

P. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

Q. Prevent contact with material that may cause corrosion, discoloration, or staining.

R. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

S. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 016000

SECTION 016116
VOLATILE ORGANIC COMPOUND (VOC) RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products, including:
   1. Adhesives.
   2. Sealants.
   3. Paints and coatings.
   4. Wood.

C. Toxic and hazardous materials to avoid.

D. Toxic and hazardous materials to limit.

E. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.

1.03 DEFINITIONS

A. Volatile: The tendency of a substance to transition from a solid or liquid state to vapor (evaporate).

B. Volatile Organic Compounds (VOC): Organic compounds that evaporate under normal atmospheric conditions. Some VOCs impact human health and comfort as odor, irritation, chronic toxicity, or carcinogenicity. Materials which produce significantly harmful VOCs are regulated by local, state, and national laws.

C. Ground Level Ozone: A "secondary" pollutant that is produced when nitrogen oxides and VOCs (primary pollutants) react with sunlight and stagnant air. Ozone in the lower atmosphere (ground level to approximately 30,000 feet) is known as ground level ozone. Aerosol sprays contribute to the production of this pollutant.

D. Global Warming Potential: Global warming potential is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide.

E. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
   1. Interior paints and coatings applied on site.
   2. Interior adhesives and sealants applied on site, including flooring adhesives.
   3. Flooring.
   4. Composite wood.
   5. Products making up wall and ceiling assemblies.
   6. Thermal and acoustical insulation.
   7. Free-standing furniture.
   8. Other products when specifically stated in the specifications.

F. Interior of Building: Anywhere inside the exterior weather barrier.

G. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

H. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

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

J. Hazardous Materials: Pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA), the International Agency for Research on Cancer (IARC) or regulated under OSHA Hazard Communication Standard, 29 CFR 1910.1200.

K. Harmful Materials: Materials which contain 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.

L. Composite Wood and Agrifiber: Products such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores that are a composite of wood and / or plant material pressed and adhered together.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).

C. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association; 2019.

D. BIFMA M7.1 - Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components, and Seating; 2011 (Reaffirmed 2021).

E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers; 2017.

F. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; Current Edition.

G. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

H. CHPS (HPPD) - High Performance Products Database; Current Edition.

I. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

J. GreenSeal GS-36 - Standard for Adhesives for Commercial Use; 2013, with Editorial Revision (2024).

K. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

L. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

M. SCS (CPD) - SCS Certified Products; Current Edition.

N. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
   1. See Section 01 6000 - Product Requirements, for acceptable documentation.

C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

PART 2 PRODUCTS

2.01 PRODUCT EMISSIONS TESTING AND STANDARDS REQUIREMENTS, GENERAL

A. Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
   1. Wet-Applied Products: State amount applied in mass per surface area.
   2. Paints and Coatings: Test tinted products, not just tinting bases.
   3. Evidence of Compliance: Acceptable types of evidence are the following;
      a. Current UL (GGG) Greenguard Gold certification.
      b. Current SCS (CPD) Floorscore certification.
      c. Current SCS (CPD) Indoor Advantage Gold certification.
      d. Current listing in CHPS (HPPD) as a low-emitting product.
      e. Current CRI (GLP) certification.
      f. Test report showing compliance and stating exposure scenario used.
   4. Product data submittal showing VOC content is NOT acceptable evidence.
   5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
   6. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1 percent weight by mass (total exempt compounds) shall be disclosed.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.
      b. Published product data showing compliance with requirements.
      c. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current SCS "No Added Formaldehyde (NAF)" certification.
         1) Web: www.scscertified.com.
      b. Report of laboratory testing performed in accordance with requirements.
      c. Published product data showing compliance with requirements.

D. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions

from Indoor Sources Using Environmental Chambers."

E. Ceilings, Walls, and Insulation: Ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Furnishings Emissions Standard and Test Method: BIFMA e3 Sections 7.6.1 and 7.6.2, tested in accordance with BIFMA M7.1.
   1. Evidence of Compliance:
      a. Test report showing compliance and stating exposure scenario used.
   2. Any furniture procured as part of this project must meet the Healthier Hospitals Initiative: Healthy Interiors (HHI-Healthy Interiors) standard for 100 percent of furniture, including being free of chemical flame retardants, unless required by code.

2.02 MATERIAL REQUIREMENTS, GENERAL

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
   1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
   2. Furnishings: Comply with Furnishings Emissions Standard and Test Method.
   3. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
   1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
   2. Aerosol Adhesives: GreenSeal GS-36.
   3. Joint Sealants: SCAQMD 1168 Rule.
   4. Paints and Coatings: Each color; most stringent of the following:
      a. 40 CFR 59, Subpart D.
      b. SCAQMD 1113 Rule.
      c. CARB (SCM).
   5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

2.03 ADHESIVES

A. The volatile organic compound (VOC) content of all field-applied adhesives, adhesive bonding primers, and adhesive primers used on the interior of this Project to not exceed the limits defined in Rule 1168 - "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California, with a rule amendment date of October 6, 2017.

B. General: For specified building construction related applications, the allowable VOC content is as follows, measured in grams per liter (g/L), less water and less exempt compounds:
   1. Architectural Applications:
      a. Building Envelope Membrane Adhesive: 250.
      b. Carpet pad adhesive: 50.
      c. Ceramic Tile Adhesive: 65.
      d. Cove Base Adhesive: 50.
      e. Gypsum Board and Panel Adhesive: 50.
      f. Multipurpose Construction Adhesive: 70.
      g. Roofing:
         1) Single-Ply Roof Membrane Adhesive: 250.

2) All Other Roof Adhesive: 250.
h. Rubber Floor Adhesive: 60.
i. Structural Glazing Adhesive: 100.
j. Structural Wood Member Adhesive: 140.
k. Subfloor Adhesive: 50.
l. VCT and Asphalt Tile Adhesive: 50.
m. Wood Flooring Adhesive: 100.
n. All Other Indoor Floor Covering Adhesives: 50.
o. All Other Outdoor Floor Covering Adhesives: 50.

2. Specialty Applications:
a. Contact Adhesive: 80.
b. Edge Glue Adhesive: 250.
c. All Other Plastic Cement:
1) ABS Welding: 325.
2) ABS to PVC Transition Cement: 510.
3) PVC Welding: 510.
4) CPVC Welding: 490.
5) All Other Plastic Welding Cements: 250.
d. Adhesive Primer for Plastic: 550.
e. Special Purpose Contact Adhesive: 250.
f. Adhesive Primer for Traffic Marking Tape: 150.
g. Structural Wood Member Adhesive: 140.
h. Top and Trim Adhesive: 250.
i. Plastic Foams: 50.

3. Substrate and Specific Applications:
a. Metal to Metal: 30.
b. Plastic Foams: 50.
c. Porous Material, Except Wood: 50.
d. Wood: 30.
e. Fiberglass: 80.
f. Reinforced Plastic Composite: 250.

4. Other:
a. Other Adhesives: 250.
b. Adhesive Bonding Primers: 250.
c. Adhesive Primers, or Any Other Primers: 250.

5. Adhesive Primers:
a. Plastic: 550.
b. Pressure-Sensitive: 785.
c. Traffic Marking Tape: 150.
d. All Other Adhesive Primers: 250.

2.04 SEALANTS

A. The volatile organic compound (VOC) content of all field-applied adhesives, adhesive bonding primers, sealant primers and sealants used on the interior of this Project to not exceed the limits defined in Rule 1168 - "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California, with a rule amendment date of October 6, 2017.

B. General: For specified building construction related applications, the allowable VOC content is as follows, measured in grams per liter, less water and less exempt compounds:

1. Sealants:
    a. Clear, Paintable, and Immediately Water-Resistant Sealant: 280.
    b. Foam Insulation and Sealant: 250.
    c. Grout Sealant: 65.
    d. Non-Staining Plumbing Putty: 150.
    e. Potable Water Sealant: 100.
    f. Roofing:
        1) Single-Ply Roofing Membrane Sealant: 450.
        2) Other Roofing Sealant: 300.
2. Sealant Primer:
    a. Architectural, Nonporous: 250.
    b. Architectural, Porous: 775.
    c. Modified Bituminous: 500.
    d. Other: 750.

2.05 PAINT AND COATINGS

A. VOC Content Requirements for Wet Applied Products: All paint and coatings wet-applied on site must meet the applicable VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.

B. Product specific requirements are as follows, measured in grams per liter, less water and less exempt compounds:
    1. Paint:
        a. Flat: 50.
        b. Non-Flat: 100.
        c. Non-Flat High-Gloss: 150.
    2. Coatings:
        a. Aluminum Roof Coatings: 400.
        b. Basement Specialty Coatings: 400.
        c. Roofing:
            1) Bituminous Roof Coatings: 50.
            2) Bituminous Roof Primers: 350.
            3) Roof Coatings: 50.
        d. Bond Breakers: 350.
        e. Building Envelope Coatings: 50.
        f. Clear Wood Finish:
            1) Varnish: 275.
            2) Sanding Sealers: 275.
            3) Lacquer: 275.
        g. Concrete Curing Compounds: 100.
        h. Concrete / Masonry Sealers: 100.
        i. Concrete Surface Retarders: 50.
        j. Dry Fog Coatings: 50.
        k. Faux Finishing Coatings:
            1) Clear Topcoat: 100.
            2) Decorative Coatings: 350.
            3) Glazes: 350.
            4) Japan: 50.
        l. Fire-Resistive Coatings: 150.
        m. Floor Coatings: 50.

n. Form-Release Compounds: 100.
o. Graphic Arts Coatings / Sign Paints: 200.
p. High-Temperature Coatings: 420.
q. Industrial Maintenance Coatings: 100.
    1) Color-Indicating Safety Coatings: 480.
    2) High-Temperature IM Coatings: 420.
    3) Non-Sacrificial Anti-Graffiti Coatings: 100.
    4) Zinc-Rich IM Primers: 100.
r. Low-Solids Coatings: 120.
s. Magnesite Cement Coatings: 450.
t. Mastic Texture Coatings: 100.
u. Metallic Pigmented Coatings: 150.
v. Multi-Color Coatings: 250.
w. Pre-Treatment Wash Primers: 420.
x. Primers, Sealers, and Undercoaters: 100.
y. Reactive Penetrating Sealers: 350.
z. Recycled Coatings: 250.
aa. Rust-Preventative Coatings: 100.
bb. Sacrificial Anti-Graffiti Coatings: 50.
cc. Shellacs:
    1) Clear: 730.
    2) Opaque: 550.
dd. Specialty Primers, Sealers, and Undercoaters: 50.
ee. Stains: 250.
ff. Stone Consolidants: 450.
gg. Swimming Pool Coatings: 340.
hh. Tile and Stone Sealers: 100.
ii. Traffic Marking Coatings: 100.
jj. Tub and Tile Refinish Coatings: 420.
kk. Waterproofing Membranes: 250.
ll. Waterproofing Sealers: 100.
mm. Waterproofing Concrete / Masonry Sealers: 100.
nn. Wood Coatings: 275.
oo. Wood Preservatives: 350.
pp. Zinc-Rich Primers: 340.

2.06 WOOD

A. Composite Wood: Use no-added-formaldehyde (NAF) or ultra-low-emitting formaldehyde (ULEF) resins.

2.07 TOXIC AND HAZARDOUS MATERIALS TO AVOID

A. Asbestos and Lead, General:
    1. No materials may be used in this project or in any tools, devices, clothing or equipment used to affect this construction that contain asebestos or lead-based paint. All work or materials found to contain asbestos or lead-base paint, or material installed with asbestos containing equipment or lead-base paint will be immediately rejected and this work will be removed by a certified EPA hazard material Contractor under the supervision of a certified hazard material consultant at no additional cost to Owner.

2. Contractor and subcontractors shall certify that no asbestos containing materials and no lead-base paint were used in this project. Certification letter must be addressed to Owner, including project and Contractors' information; to be notarized.

B. Avoid the use of the following toxic and hazardous materials. Refer to Definitions article above.
1. Asbestos: No products containing asbestos.
2. Lead: Products containing lead content, including older or flux containing not more than 0.25 percent lead in wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures, and 0.20 percent for solder or flux used in plumbing for water intended for human consumption.
3. Mercury:
   a. No new mercury containing thermometers, switches and electrical relays.
   b. All lamps compliant with low-mercury limits.
      1) Illuminated exit signs only use Light-Emitting Diode (LED) or Light-Emitting Capacitor (LEC) lamps.
   c. No mercury vapor or probe-start metal halide high intensity discharge lamps.
4. Added Urea-Formaldehyde: Prefabricated wood products, composite wood, and agrifiber products to contain no added urea-formaldehyde resins.
   a. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.
5. Sealants: Provide products that comply with specified VOC limits. Refer to Section 079200 - Joint Sealants, for additional requirements.
   a. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
6. Avoid the use of the following products: butyl rubber, solvent acrylic, neoprene, styrene butadiene rubber, and nitril.
7. Avoid the use of products containing CFC's or HCFC's.

2.08 TOXIC AND HAZARDOUS MATERIALS TO LIMIT

A. Limit the use of the following toxic and hazardous materials. Refer to Definitions article above.
1. Halogenated and Organophosphorous Flame Retardants: Limit to 100ppm in the following categories to the extent allowable by local code:
   a. Window and waterproofing membranes, door and window frames and siding.
   b. Flooring, ceiling tiles and wall coverings.
   c. Piping and electrical cables, conduits and junction boxes.
2. Phthalate (Plasticizers): DEHP, DBP, BBP, DINP, DIDP or DNOP (often found in polyvinyl chloride PVC) are limited in the following components to 0.01 percent (100 ppm):
   a. Flooring, including resilient and hard surface flooring and carpet.
   b. Wall coverings, window blinds and shades, shower curtains, furniture and upholstery.
   c. Plumbing pipes.
   d. Moisture barriers.
3. Isocyanate-Based Polyurethane: Not to be used in interior finishes.
4. Urea-Formaldehyde: Limited to 100 ppm in the following components:
   a. Furniture.
   b. Composite wood products.
   c. Laminating adhesives and resins.
   d. Thermal insulation.
5. Perfluoroalkyl and polyfluoroalkyl substances (such as stain and water repellants).
6. Antimicrobials.
7. Fly ash.
8. Methylene chloride and perchloroethylene shall not be intentionally added in paints, coatings, adhesives, or sealants.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements.

B. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

C. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION 016116

SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Protection of installed work.

G. Starting of systems and equipment.

H. Final cleaning.

I. Demonstration and instruction of Owner personnel.

J. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

K. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 013000 - Administrative Requirements: Submittals procedures, additional meetings not specified here.

C. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

D. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

E. Section 078400 - Firestopping.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.

5. Work of Owner or separate Contractor.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

A. Perform dewatering activities, as required, for the duration of the project.
   1. See Section 015000 - Temporary Facilities and Controls for additional information.

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

C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
      a. See Section 015000 - Temporary Facilities and Controls for additional information.

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. See Section 011000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations. Furnish information to local uitlity and Owner where necessary to adjust, move, or relocate existing utilities and appertenances.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

1.02 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

1.03 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

1.04 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.05 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

1.06 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.07 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

1.08 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Substantial Completion

1. Prepare and submit a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.

a. Advise Owner of pending insurance changeover requirements.

b. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

c. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

d. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

e. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

f. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
g. Complete startup testing of systems.
h. Submit test/adjust/balance records.
i. Complete commissioning requirements.
j. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
k. Advise Owner of changeover in heat and other utilities.
l. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
m. Complete final cleaning requirements, including touchup painting.

2. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
   a. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
3. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
4. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

C. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

D. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

1.09 FINAL COMPLETION

A. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

B. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

C. Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment.
   2. Submit copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), certified by the Contractor, stating that each item has been completed or otherwise resolved for acceptance. This inspection list will be reviewed and dated by Architect.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report and warranty.
   5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
      a. Submit demonstration and training video recordings.

D. Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will notify Contractor of construction that must be completed or corrected.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Following completion of all final inspection items, Contactor shall prepare and submit a final Certificate for Payment.
3. Owner may proceed with preparation of Notice of Final Completion.

1.10 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 017000

SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for management and disposal of construction waste, including waste management plan.

1.02 WASTE MANAGEMENT REQUIREMENTS

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
   1. Provide containers with lids. Remove trash from site periodically.
   2. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

B. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

C. Owner requires that this project generate the least amount of trash and waste possible.
   1. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
   2. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
   1. Aluminum and plastic beverage containers.
   2. Corrugated cardboard.
   3. Wood pallets.
   4. Clean dimensional wood.
   5. Land clearing debris, including brush, branches, logs, and stumps.
   6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
   7. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   8. Glass.
   9. Gypsum drywall and plaster.
   10. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
   11. Paint.
   12. Plastic sheeting.
   13. Rigid foam insulation.

E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.

F. Develop and follow a Waste Management Plan designed to implement these requirements.

G. The following sources may be useful in developing the Waste Management Plan:

H. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.03 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures.

B. Section 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

D. Section 016000 - Product Requirements: Waste prevention requirements related to product substitutions.

E. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

F. Section 017000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.04 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. 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.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements.

B. Waste management plan.

C. Waste disposal records.

1.06 WASTE MANAGEMENT PLAN

A. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

B. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
   4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

1.07 WASTE DISPOSAL REPORTS

A. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.

d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

4. Incinerator Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
   c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
5. Recycled and Salvaged Materials: Include the following information for each:
   a. Identification of material, including those retrieved by installer for use on other projects.
   b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
   c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards.
   c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

B. Recycling Incentive Programs:
   1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
   2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 016000 and Section 012500.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 016000:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 017419

SECTION 017800.01

WARRANTY/GUARANTEE FORM – NOTICE OF COMPLETION

FOR _____ WORK

We, the undersigned, do hereby warranty and guaranty that the parts of the work described above which we have furnished or installed for:

Project Name: (Insert Project Name)

Owner: (Insert Owner's Name)

Location: (Insert Project Location)

are in accordance with the Contract Documents and that all said work as installed will fulfill or exceed all the Warranty and Guaranty requirements. We agree to repair or replace work installed by us, together with any other work which is displaced or damaged by so doing that proves to be defective in workmanship, material, or operation within a period of:

(Insert Written Years) (Insert Arabic Numeral of Years) Years(s)

from the date of filing of the Notice of Completion, ordinary wear and tear and unusual neglect or abuse excepted.

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

Date:_____

(Insert Name of Contractor)	(Insert Name of Subcontractor, Sub-Subcontractor, Manufacturer or Supplier)
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
State License No: _____	State License No: _____

Local Representative: For Maintenance, Repair, or Replacement Service, Contact:

Name: _____

Address: _____

Phone Number: _____

SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal requirements.

B. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

C. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

D. Warranties and Bonds:
   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 Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

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.

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 modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   3. Field changes of dimension and detail.
   4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide control diagrams by controls manufacturer as installed.

J. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

K. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

L. Include test and balancing reports.

M. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each

volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include photocopies of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION 017800

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Landscape irrigation.
   7. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.

h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 017900

SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 011000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

C. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 312200 - Grading: Rough and fine grading.

H. Section 312323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 DEFINITIONS

A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.

B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.

D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Site Plan: Indicate:

1. Vegetation to be protected.
2. Areas for temporary construction and field offices.
3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
2. Summary of safety procedures.
3. Demolition firm qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: See Section 312323.

PART 3 EXECUTION

3.01 DEMOLITION

A. Remove paving and curbs required to accomplish new work.

B. Remove concrete slabs on grade within site boundaries.

C. Remove other items indicated, for salvage, relocation, and recycling.

D. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 312200.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with requirements in Section 017000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
1. Obtain required permits.
2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
3. Provide, erect, and maintain temporary barriers and security devices.
4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Protect existing structures and other elements to remain in place and not removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
   1. Verify construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

C. Remove existing work as indicated and required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
   2. Remove items indicated on drawings.

D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.

2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove materials not to be reused on site; comply with requirements of Section 017419 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 024100

SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 051200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the 2022 edition of the California Building Code (CBC), including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.

1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 303R – Guide to Cast-in-Place Architectural Concrete for Buildings.
4. ACI 318 - Building Code Requirements for Structural Concrete.
5. ACI 347R - Guide to Formwork for Concrete.
6. ASME A17.1 - Safety Code for Elevators and Escalators.
7. ASTM D1621 – Test Method for Compressive Properties of Rigid Cellular Plastics.
8. ASTM D1622 – Standard Test Method for Apparent Density of Rigid Cellular Plastics
9. ASTM D6817/D6817M – Standard Specification for Rigid Cellular Polystyrene Geofoam
10. U.S. Department of Commerce Product Standard:
    a. PS 1 - Structural Plywood.
11. West Coast Lumber Inspection Bureau (WCLIB):
    a. Grading and Dressing Rules No. 17
12. United States Green Building Council (USGBC):
    a. Leadership in Energy and Environmental Design (LEED):
    b. Green Building Rating System.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials and installation requirements.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
   1. Indicate location of form ties on exposed concrete walls.
   2. Include locations and placement of steel embeds.
   3. Indicate proposed locations of constructions joint.

D. Shoring and Reshoring:
   1. Submit for records proposed design of shoring, schedule and sequencing of shoring installation and removal, and installing and removing reshoring.

E. Designer's Qualification Statement.

F. Design Data: As required by authorities having jurisdiction.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design formwork under direct supervision of a Professional Civil or Structural Engineer experienced in design of concrete formwork and licensed in the State in which the Project is located.

B. Neither the Architect nor the Architect's consultants have been retained to design formwork, nor to determine the means and methods by which such operations are accomplished.

C. Prior to erecting formwork, coordinate locations of plumbing, mechanical, and electrical blockouts in concrete slabs.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

C. Protect plastic foam products from damage and exposure to sunlight.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete forms that complies with design with respect to shape, lines, and dimensions.

C. Limit deflections to 1/8" between supports after placement of concrete.

D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

E. Formwork design shall comply with ACI 347R, ACI 301, and ACI 318.
   1. Design shall be based on calculations prepared by a licensed engineer in the State in which the Project is located.

F. Erect formwork in a manner that will ensure the safety of construction personnel and the public.

2.02 WOOD FORM MATERIALS

A. Plywood: PS 1, Grade B-B, Class I.
   1. Douglas Fir species; solid one side grade; sound undamaged sheets with clean, true edges.

B. Lumber: Douglas species; structural grade; with grade stamp clearly visible.

2.03 METAL FORM MATERIALS

A. Metal: Min 16 ga sheet steel, tight fiitting, and stiffened to support weight of concrete such that tolerances are maintained.

B. Metal Deck Forms: Metal deck as specified in Contract Drawings.

2.04 FORMWORK ACCESSORIES

A. Form Ties: Removable or snap-off type, galvanized metal or glass-fiber-reinforced plastic, fixed length, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.
   1. Ties should leave no corrodible metal closer than 1 inch to exposed concrete surface.
   2. Ties shall be designed to resist lateral pressure of concrete on forms and prevent spalling of concrete on removal.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
   1. Composition: Colorless reactive, mineral oil-based, soy-based, or vegetable-oil based compound.
   2. VOC Content: In compliance with applicable local, State, and federal regulations.
   3. Products:
      a. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/#sle.
      b. W. R. Meadows, Inc; Duogard: www.wrmeadows.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.

D. Filler Strips for Chamfered Corners: Rigid plastic or wood type; size per contract drawings; maximum possible lengths.

E. Flashing Reglets: Galvanized steel, at least 22 gage, 0.0299 inch thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

G. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 051200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth Forms may be used if compacted fill or natural soil can be accurately cut and maintained.

B. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 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 dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

G. Coordinate this section with other sections of work that require attachment of components to formwork.

H. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply non-staining, rust-preventative form oil or other means of protection against rusting to steel forms.
   1. Rust-stained steel formwork is not acceptable for use.

C. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

F. 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.

G. 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.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse formwork without Architect's approval. When approved, do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.
   1. Reused formwork shall meet appearance requirements of new formwork.
   2. Reused formwork shall be free of splaying, fraying, delamination or other damage.
   3. Follow all requirements as for new formwork.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after curing at not less than 50 degrees F for 72 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed until concrete has attained 28-day minimum design compressive strength, but in no case less than 21 days for standard reinforced concrete and 7 days for post-tensioned concrete. Determine potential compressive strength of in- place concrete by testing representative field-cured concrete specimens of concrete in question.

D. Form facing material may be removed 7 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

E. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

F. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

G. If accelerated form removal is desired, submit methods to Architect for review. Review by Architect does not alleviate contractor of responsibility for means and methods of construction and protection of structure during construction.

H. Reshore members as required in section below.

3.10 RESHORING

A. Shoring and reshoring shall conform to the requirements of ACI 347.

B. Extend shoring and reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete.

C. Plan and sequence removal of shores and reshore to avoid damage to concrete. Provide adequate reshoring to support construction without excessive stress or deflection.

D. Shores shall not be removed prior to concrete achieving 28 day strengths.

E. While reshoring operations are under way, no construction ldoads shall be permitted on the new construction.

END OF SECTION 031000

SECTION 032000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

C. Reinforcing steel for masonry work.

1.02 RELATED REQUIREMENTS

A. Section 014113.11 - Regulatory Requirements - Global Warming Potential (GWP)

B. Section 031000 - Concrete Forming and Accessories.

C. Section 033000 - Cast-in-Place Concrete.

D. Section 042000 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the 2022 edition of the California Building Code (CBC), including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.

1. ACI 301 - Specifications for Concrete Construction.
2. ACI 315 – Details and Detailing of Concrete Reinforcement.
3. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
4. ACI MNL-66 - ACI Detailing Manual.
5. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
6. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
7. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
8. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
9. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
10. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination
11. AWS A5.1 – Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
12. AWS A5.5 – Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
13. AWS D1.1/D1.1M – Structural Welding Code – Steel.
14. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.
15. AWS D1.8/D1.8M - Structural Welding Code - Seismic Supplement.
16. CRSI (DA4) - Manual of Standard Practice.
17. CRSI (P1) - Placing Reinforcing Bars.

B. California Code of Regulations (CCR):

1. CBSC, Title 24, Part 2- California Building Code (CBC), 2022 edition.
   a. Chapter 17 - Structural Tests and Inspections
   b. Chapter 19 - Concrete
2. CBSC, Title 24, Part 11 - California Green Building Standards Code (CALGreen)
   a. Supplement 1, July 2024

C. US Army Corps of Engineers (USACE)
1. CW03210: Civil Works Construction Guide Specifications for Steel Bars, Welded Wire Fabric and Accessories for Concrete Reinforcement

D. United States Green Building Council (USGBC):
1. Leadership in Energy and Environmental Design (LEED):
2. Green Building Rating System.

1.04 GENERAL

A. Coordination: Refer to Section 017419 - Construction Waste Management and Disposal regarding procedures for implementing construction waste management requirements.

B. Coordination: Coordinate Work specified in this Section with other Sections which require placement of embedded products and provision of openings and recesses. If formwork is placed after reinforcing, resulting in insufficient concrete cover over reinforcing, request instructions from Architect (Structural Engineer) before proceeding.

C. Refer to Section 013000 - Administrative Requirements for RFI requirements.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Reinforcing Shop Drawings:
1. Prepare Shop Drawings in accordance with the applicable requirements of ACI 318 and the CRSI Manual.
2. Provided scaled, dimensioned reinforcing plans for each floor level indicating size and spacing of reinforcing. Coordinate additional bars with locations of slab openings, penetrations, depressions and steps. Shop drawing shall be coordinated with concrete shop drawings. Ensure penetrations from affected trades for utilites are coordinated.
3. Provide scaled, dimensioned reinforcing elevations for each wall line indicating size and spacing of reinforcing. Coordinate additional bars with locations of openings, penetrations, and recesses. Shop drawing shall be coordinated with concrete shop drawings. Ensure penetrations from affected trades for utilites are coordinated.
4. Indicate welds in accordance with AWS D1.4/D1.4M and AWS A2.4.
5. Indicate type of corrosion resistant reinforcing proposed and locations, if applicable.
6. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. Test Reports: Submit certified laboratory test reports confirming physical characteristics of materials used in the performance of the work of this Section.
1. Where reinforcing is subject to welding, submit carbon equivalent determination reports in accordance with requirements of Source Quality Control.

D. Certificates: Submit copies of steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel. Transmit copy to installer for welded splices.

E. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

F. Sustainable Design Submittals:
1. Type III factory-specific or product-specific environmental product declarations (EPD) for each grade of reinforcement proposed for the project.

2. Materials & Resources Submittals: Refer to Section 018113 for additional information on LEED Submittals.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 318, ACI 301, CRSI and CBC Chapter 19.

B. Fabricator's Qualifications:
   1. When required, show evidence of approval by governmental agencies having jurisdiction.

C. Welding of reinforcing shall be in conformance with AWS D1.1/D1.1M, AWS D1.4/D1.4M, AWS D1.8/D1.8M, and CBC Chapter 19.

D. Qualification of Welds, Welding operators, and welders:
   1. Comply with applicable building code standard. Perform welding procedure qualification, except for prequalified procedures, as required by AWS D1.4/D1.4M, prior to executing any welding of reinforcing steel.
   2. Only AWS Certified Welding Inspectors shall be used for tests and qualifications associated with welding of reinforcing steel.
   3. Only AWS qualified welders or welding operators shall perform welding of reinfocing steel.
   4. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months and in accordance with AWS D1.4/D1.4M.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage. Deliver reinforcing materials bundled and with identifying labels or tags affixed and legible.
   1. Bundle reinforcing, tag with identification, and transport and store so as not to damage any material. Use metal tags indicating size, length and other marking shown on placement drawings. Maintain tags after bundles are broken.

B. The Inspector and/or Architect reserves the right to observe deliveries, to review bills of lading, and to reject the following:
   1. Reinforcing not accompanied by required mill certificates.
   2. Reinforcing exhibiting rusting or other contamination which might prohibit or inhibit bonding of concrete.

C. Store materials off ground and under cover.
   1. Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening contaminants.
   2. Store welding electrodes in accordance with AWS standards.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Provide deformed-type reinforcing conforming to ASTM Standards and material Grades as noted on Structural Contract Drawings.
   1. When welding is indicated, provide reinforcing conforming to the requirements of ASTM A 706, Grade 60.

B. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: As indicated on drawings.

C. Global Warming Potential (GWP) Limit: as indicated on the drawings.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch, conforming to ASTM A1064/A1064M , Grade 60.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Provide stainless steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 MECHANICAL REBAR SPLICING:

A. Coupler Systems: For use where indicated on drawings, mechanical devices for splicing reinforcing bars; designed to develop minimum 1.25Fy or Fu of the reinforcing bars in both tension and compression, conforming to ACI 318 Type II coupler. Splicing system shall be listed by the International Code Council (ICC) or by the International Association of Plumbing and Mechanical Officials Evaluation Service (IAPMO-ES)
   1. Mechanically Locked Sleeves: Steel sleeves with internal gripping rails and external shear bolts, designed to positively engage the unaltered ends of butted reinforcing bars.
      a. Products: Dayton Superior “Bar-Lock" System.
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Dowel Bar Splicers: Integral forged bar end, female-threaded, with nailing flange on one bar and integral matching male threads on the other bar. Provide specially forged bar ends, such that the cut male threads do not diminish the original bar cross section dimension.
      a. Products: Dayton Superior; "DBDI" System.
      b. Substitutions: See Section 016000 - Product Requirements.

2.03 FABRICATION

A. Do not fabricate reinforcing until shop drawings have been reviewed by LPA.

B. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice, ACI MNL-66: Detailing Manual, and ACI 318.

C. In case of fabrication errors, do not rebend or straighten reinforcing in a manner that will injure or weaken the material.

D. Do not heat reinforcing to faciliate bending.

E. Welding of reinforcement is permitted only where shown on drawings using ASTM A706 reinforcing. Perform welding in accordance with AWS D1.4/D1.4M.
   1. Protect joints from drafts during cooling process. Accelerated cooling is prohibited.
   2. Do not tack weld reinforcing.
   3. Fusion welding is not permitted unless approved by Engineer of Record.

F. Locate reinforcing splices not indicated on drawings at point of minimum stress.

G. Comply with tolerances per ACI 117 and CRSI Manual.

H. Reinforcing with any of the following defects will not be permitted:
   1. Lengths, depths, and bends not conforming to the spcified fabrication tolerances.
   2. Bends or kinks not indicated in the drawings.
   3. Reinforcing with reduced cross-section due to excessive rusting or other causes.

2.04 SOURCE QUALITY CONTROL

A. Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry recognized procedures.

B. Reinforcing to be welded:

1. Submit a copy of the mill test report to the Architect prior to placement of reinforcing steel in concrete members.
2. If mill test reports are not available, perform a chemical analysis of reinforcing representative of the reinforcing to be welded. The carbon equivalent (CE) shall not exceed 0.55.
3. Special inspection is required for welding of steel reinforcing.

C. Source Quality Control: Testing Laboratory shall test samples of reinforcing, ties, and stirrups from the material at the site or from place of distribution. Each sampling shall include at least two 18-inch long pieces. Perform the following tests according to ASTM A615:
1. Identified Reinforcing: Samples shall be obtained from bundles delivered from the mill, identified by heat number and accompanied by mill analyses and mill test reports. Reinforcing shall be properly tagged with Identification Certificate so as to be readily identified. Then perform one tensile and one bend test for each 10 tons or fraction thereof of each size of reinforcing per CBC Section 1909.2.4. Submit mill reports when samples are selected.
2. Unidentified reinforcing is not permitted.
3. Refer to Section 014000 - Quality Requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean reinforcing to remove loose rust and mill scale, earth, and other materials which might reduce or destroy bond with concrete.

3.02 PLACEMENT

A. General: Comply with the CRSI Manual of Standard Practice and CRSI Placing Reinforcing Bars, 10th edition, for details and methods of placing reinforcing and supports.
1. Do not displace or damage vapor barrier while placing concrete reinforcing. If damage occurs, repair vapor barrier before placing concrete.
   a. Provide for movement which equals joint width plus 1/2-inch.
2. Expansion Joints in Slab-on-grade: Interrupt reinforcing at expansion joints. Provide No. 5 by 24-inch long dowelled joints at 18 inches on centers with one end of dowel set in capped dowel sleeve.
3. Construction Joints: Allow reinforcing to run through without interruption, unless otherwise noted on Contract Structural Drawings.

B. Support: Position, support, and secure reinforcing against displacement by formwork, construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers as required and as indicated on Contract Drawings.
1. Provide sufficient numbers and sizes of supports to carry reinforcing.
   a. Do not place reinforcing more than 2 inches beyond the last leg of any continuous reinforcing support.
   b. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
   c. Provide additional reinforcing for support where required to support reinforcing shown on Contract Drawings.
2. Repair and resupport reinforcing which may have moved during concrete placement operations.

C. Securing in Place:

1. Accurately place reinforcing and wire tie in precise position where reinforcing cross. Bend ends of wire ties away from the forms. Wire tie reinforcing to corners of ties and stirrups.
2. Support reinforcing according to the current edition of CSRI Recommended Practice for Placing Reinforcing Supports using approved accessories and chairs.
3. Place precast concrete cubes with embedded wire ties to support reinforcing steel in concrete placed on grade and in footings. Precast concrete cubes are not acceptable in elevated concrete slabs, beams, or concrete filled metal deck.
4. Use care not to damage vapor barriers where they occur.
5. Dowel Bar Couplers:
   a. Attach flanged, internally threaded end of dowel bar coupler to inside of formwork, using nails or screws.

D. Coverage: Place reinforcing to obtain minimum coverages for concrete protection in accordance with ACI 318 Chapter 20.5.1.3, or as indicated on Contract Structural Drawings. Securely tie reinforcing and related supports together with tie wire to hold reinforcing accurately in position during concrete placement operations. Place wire ties so that twisted ends are directly away from exposed concrete surfaces.

E. Clearance Between Reinforcing: Per ACI 318 and as indicated on Contract Drawings.

F. Splicing:
1. Provide standard reinforcing splices by lapping ends and tying securely with tie wire. Comply with details indicated on Contract Structural Drawings.
   a. Unless noted otherwise on Contract Drawings, comply with requirements of ACI 318 for minimum lap of Class B spliced reinforcing, including ACI 318 as amended by CBC.
2. Provide 1-1/2-inch minimum clearance between sets of splices. Stagger horizontal reinforcing so that adjacent splices are greater than 4 feet apart, unless noted otherwise on Structural Contract Drawings.
3. Field Welding: Comply with the requirements of AWS D1.4 where field welding is required. Prior to field welding, determine the weldability of reinforcing in accordance with section "Source Quality Control" in Part 2. Only steel conforming to the chemical requirements of AWS D1.4 may be welded.
4. Splices: Do not splice reinforcing at the points of maximum stress except where indicated. Lap splices as shown or required to develop the full strength of reinforcing. Stagger splices in horizontal wall reinforcing at least 24" longitudinally in alternate reinforcing and opposite faces.
5. Mechanical Couplers:
   a. Mechanically Locked Sleeves:
      1) During installation, ensure no damage or misalignment occurs to gripping rails; discard sleeve if damage occurs.
      2) Insert first reinforcing bar completely, until it contacts internal divider.
      3) Holding bar in position, hand-tighten all bolts.
      4) Repeat above procedure for second bar.
      5) In random, alternating order, tighten all bolts to 50% of the specified torque.
      6) In random, alternating order, tighten all bolts to 75% of the specified torque
      7) In random, alternating order, drive each bolt until head shears off.
   b. Dowel Bar Couplers:
      1) Splice open end of dowel bar to internal reinforcing steel.
      2) After concrete has set up, thread externally threaded dowel bar into internally threaded dowel bar; hand tighten.
      3) Then, attempt to rotate coupler further 1/4 turn by hand-tightening.
      4) Splice open end of dowel bar to internal reinforcing steel.

G. Wire Fabric: Install welded wire fabric in longest lengths practicable. Lap adjoining pieces at least 12 inches minimum, and lace splices with tie wire. Offset end laps in adjacent widths to prevent continuous laps.
   1. Extend fabric to within 1 inch of edge at slabs.

H. Slab on Grade Reinforcing: Do not displace or damage vapor retarder at slab on grade.

I. Dowels: Secure tie dowels in place before depositing concrete. Provide No. 3 reinforcing for securing dowels where no other reinforcing is provided

J. Maintaining Reinforcing in Position: Provide adequate means to ensure that reinforcing position and spacing is maintained during placement of concrete.

K. Adjustment and Inspection: Do not bend or straighten reinforcing in a manner injurious to material. Do not use reinforcing with kinks or bends not shown on Drawings and reviewed shop drawings or reinforcing with reduced cross-section due to corrosion or other cause.

L. Tolerances: Placement tolerances shall conform to CRSI Manual of Standard Practice and ACI 117.

3.03 MASONRY REINFORCING

A. Refer to section 042000 - Unit Masonry for installation of masonry reinforcing.

B. Splice reinforcing in masonry with laps as indicated on Contract Drawings.

C. Position vertical reinforcing in masonry walls and tie in position top and bottom, and at intervals not exceeding 192 bar diameters, unless noted otherwise on the Contract Drawings.

D. Provide dowels between footings and walls of the same grade, size, and spacing as vertical wall reinforcing, unless noted otherwise on the Contract Drawings.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 014000 - Quality Requirements, will inspect installed reinforcement for conformance to contract documents before concrete placement.

B. Inspection and Tests of Welds: Provide special inspection of shop and field welding in accordance with CBC Section 1704, 1705, 1903, and Structural Contract Drawings.
   1. Tests will be made by testing laboratory for reinforcing welds, as follows:
      a. Qualification of welders engaged in electric-arc welding of reinforcing.
      b. Verification of location of reinforcing for accuracy.
      c. Inspection of reinforcing welds by certified welding inspectors.
      d. X-ray test of one of the first three arc-welds made by each welder.
   2. Tensile tests of sample welds of the largest size reinforcing for each type of welding.
   3. When welds are judged to be deficient, provide and pay for such additional X-rays and tests as directed by the Architect. Defective welds shall be repaired, replaced, and retested.

C. Placing: Provide special inspection as required by CBC 1705.
   1. Placement of Grade 60 or higher reinforcing steel for concrete above grade requires special inspection.
   2. Schedule inspecting of reinforcing steel for conduit, sleeves, and embedded items to allow for correction, if necessary, before placement of overlying grids on reinforcing steel.

3.05 ADJUSTING

A. Defective Reinforcing Work: The following shall be considered defective and may be ordered removed and reconstructed at no change in Contract Time or Contract Sum:
   1. Reinforcing with kinks or bends not shown on Contract Drawings.
   2. Reinforcing injured due to bending or straightening.

3. Reinforcing heated or bent.
4. Reinforcing not placed in accordance with Contract Documents.
5. Reinforcing that is rusty or oily.
6. Reinforcing exposed in surface of concrete

END OF SECTION 032000

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete building frame members.

B. Elevated concrete slabs.

C. Floors and slabs on grade.

D. Concrete shear walls, elevator shaft walls, and foundation walls.

E. Concrete foundations.

F. Joint devices associated with concrete work.

G. Site Concrete Elements, including, but not limited to freestanding walls and their foundations, retaining walls and their foundations, light pole bases and their foundations, and flagpole bases and their foundations.

H. Miscellaneous concrete elements, including equipment pads and equipment pits.

I. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 014113.11 - Regulatory Requirements - Global Warming Potential (GWP)

B. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork.

C. Section 032000 - Concrete Reinforcing.

D. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

E. Section 323353 - Architectural Site Concrete for additional requirements for retaining walls and other site concrete.

1.03 REFERENCE STANDARDS

A. The applicable version of the standards listed below shall be per Chapter 35 of Part 2 of the 2022 edition of the California Building Code (CBC), including addendums and errata. Where the standard is not listed, then the most current version of the standard shall be used or as referenced by other standards.

1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
2. ACI 211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.
3. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
4. ACI 232.2R – Report on the Use of Fly Ash in Concrete
5. ACI 233R – Guide to the Use of Slag Cement in Concrete
6. ACI 234R – Guide for the Use of Silica Fume in Concrete
7. ACI 301 - Specifications for Concrete Construction.
8. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
9. ACI 303R – Guide to Cast-in-Place Architectural Concrete Practice
10. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
11. ACI 305R - Guide to Hot Weather Concreting.

12. ACI 306R - Guide to Cold Weather Concreting.
13. ACI 308R - Guide to External Curing of Concrete.
14. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
15. ACI 347R - Guide to Formwork for Concrete.
16. ACI 360R – Guide to Design of Slabs-on-Ground
17. ACI 503.4 – Standard Specification for Repairing Concrete with Epoxy Mortars
18. ACI MNL-15 – Field Reference Manual
19. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
20. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
21. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
22. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
23. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
24. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens).
25. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
26. ASTM C150/C150M - Standard Specification for Portland Cement.
27. ASTM C157/C157M - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
28. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
29. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete.
30. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
31. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
32. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
33. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
34. ASTM C295/C295M - Standard Guide for Petrographic Examination of Aggregates for Concrete.
35. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
36. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete.
37. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
38. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
39. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.
40. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
41. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
42. ASTM C755 - Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation.
43. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete.
44. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars.
45. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

46. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
47. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
48. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
49. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
50. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
51. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
52. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
53. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
54. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
55. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
56. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
57. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
58. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
59. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
60. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

B. California Code of Regulations (CCR):
   1. CBSC, Title 24, Part 2- California Building Code (CBC), 2022 edition.
      a. Chapter 11b - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing:
         1) Division 3 - Building Blocks.
            (a) Section 11B-302 - Floor or Ground Surfaces.
         2) Division 4 - Accessible Routes.
            (a) Section 11B-403 - Walking Surfaces.
      b. Chapter 17 - Structural Tests and Inspections.
      c. Chapter 19 - Concrete.
   2. CBSC, Title 24, Part 11 - California Green Building Standards Code (CALGreen), 2022 edition.
      a. Supplement 1, July 2024

C. US Army Corps of Engineers (USACE)
   1. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops 1974.

D. ICC Evaluation Service, Inc. (ICC ES), a subsidiary corporation of the International Code Council:
   1. ICC ES Evaluation Reports (ESR) for Materials, Products, Methods, and Types of Construction with current report conforming to the applicable building code.

E. International Association of Plumbing and Mechanical Officials (IAPMO):
   1. IAPMO Uniform Evaluation Service (UES) Report for Materials, Products, Methods, and Types of Construction with current report conforming to the applicable building code.

F. Public Works Standards, Inc. (PWS):

1. Standard Specifications for Public Works Construction, (Greenbook), latest edition with amendments, published by BNi Building News.

G. United States Green Building Council (USGBC):
1. Leadership in Energy and Environmental Design (LEED):
2. Green Building Rating System.

1.04 GENERAL

A. Identify finish flooring manufacturers' concrete slab vapor emission and alkalinity requirements and coordinate concrete slab mixing and installation procedures to achieve desired results. Concrete slab requirements for finish flooring may be more restrictive than general requirements of the Contract Documents, and may require additional materials, means, or methods. Additional materials, means, or methods shall be included as part of the work.

B. Coordinate method of securing reinforcing and other embedded items in concrete slabs on grade without penetrating vapor barriers.

C. Verify depth of slab depressions for waterproofing and toppings at walking decks.

D. Verify depth of slab depression for frame and pan of entrance floor grilles. Coordinate leveling of floor with floor leveling compound and embedment of frame.

1.05 DEFINITIONS

1.06 EMBODIED CARBON FOOTPRINT: EMBODIED CARBON IS THE CARBON DIOXIDE EQUIVALENT (CO2E) FOOTPRINT OF THE PROJECT BEFORE IT BECOMES OPERATIONAL. EMBODIED CARBON IS EXPRESSED AS GLOBAL WARMING POTENTIAL (GWP).

A. Global Warming Potential: Global Warming Potential (GWP) is the heat absorbed by any greenhouse gas in the atmosphere as a multiple of the heat that would be absorbed by the same mass of carbon dioxide. GWP is 1 for CO2. GWP for reinforcing is expressed as kg of CO2e per metric ton of fabricated steel reinforcing.

B. Environmental Product Declaration: An Environmental Product Declaration (EPD) quantifies environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function. EPDs are conducted in accordance with a Product Category Rule for the specific product being evaluated.

C. Product Category Rule: Product Category Rules (PCR) are a set of rules, requirements, and guidelines for developing Environmental Product Declarations (EPD) for one or more categories.

D. Life Cycle Assessment: Life Cycle Assessment (LCA) is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions, along with agency approvals (ICC, IAPMO, etc.) where applicable.

C. Mix Design: Submit proposed concrete mix design for approval.
1. Submit design mix data for each type of concrete and each compressive strength required on the Contract Drawings. Submittal of mix designs shall not relieve Contractor of its responsibility to furnish concrete of proper consistency and specified strengths. Where used for concrete subject to special inspections, submit mix designs to testing laboratory for review and written acceptance.

a. Indicate proposed mix design complies with requirements of ACI 301, Section 4 and ACI 318 26.4.3.
b. Design mix submittal shall be stamped and signed by a professional engineer licensed in the State of California.
c. For each material, including admixtures and water, state water-cement ratio and maximum allowable water content.
d. For each material, state manufacturer's name, designation, and source.
e. Submit shrinkage and creep factors for each type of aggregate, and each source proposed for use, for acceptance-review.
f. For each mix design:
    1) Pay costs associated with mix design preparation.
    2) Consider concrete cover and clear distances between reinforcing bars as indicated on the Contract Drawings in determining the aggregate size for mix designs. This may result in an aggregate size smaller than specified elsewhere in this Specification.
    3) Submit a schedule which identifies the locations within the structure where each mix design is proposed for use.
    4) Submit project specific 28-day shrinkage test results in accordance with shrinkage test requirements in Part 2 "CONCRETE MIX DESIGN."
    5) Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.

D. Shop Drawings. Concrete shop drawings shall be coordinated with shop drawings requirements for reinforcement and formwork. Submit the following items for review:
1. Layout drawings showing locations of slab-on-grade joints.
2. Scaled, dimensioned plans for each floor level indicating size and location of slab openings, penetrations, depressions, and steps. Shop drawing shall be coordinated with reinforcing shop drawings. Ensure penetrations from affected trades for utilities are coordinated.
    a. Provided review stamp, with signature and date, of each trade proposed to work within the opening or penetration.
3. Proposed Construction Joints.
4. Scaled, dimensioned concrete elevations for each wall line indicating size and location of openings, penetrations, and recesses. Shop drawing shall be coordinated with reinforcing shop drawings. Ensure penetrations from affected trades for utilities are coordinated.
    a. Provided review stamp, with signature and date, of each trade proposed to work within the opening or penetration.

E. Concrete Placement Schedule: Submit the proposed concrete placement schedule to the Architect for review prior to start of concrete placement.

F. Samples:
1. Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.
2. Submit samples of underslab vapor retarder to be used.
3. Submit two, 12 inch long samples of waterstops and construction joint devices.
4. Aggregate proposed for exposed finish, indicating color, texture, and size, for acceptance-review. Submit not less than 1 pound of aggregate.

G. Test Reports: Submit report for each test or series of tests specified.
1. Submit certified laboratory test reports to Architect and, when applicable, the authority having jurisdiction, confirming physical characteristics of materials used.
2. Shrinkage and petrographic tests on concrete with the proposed aggregate.

H. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.

2. Aggregates and sand.
3. Admixtures.
4. Fiber reinforcement.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semi-rigid joint filler.
11. Joint-filler strips.
12. Repair materials.

I. Sustainable Design Submittals:
   1. Embodied Carbon Footprint Submittals
      a. Plant-specific Environmental Product Declaration (EPD) for each concrete mixture proposed for the project accompanying each concrete mixture submittal.
      b. A calculation showing that the Global Warming Potential (GWP) of all the concrete supplied for the project shall be lower than the GWP target set in Section 2.
   2. Materials & Resources Submittals: Refer to Section 018113 for additional information on LEED submittals.
   3. Indoor Environmental Quality Submittals: Refer to Section 018113 for additional information on LEED submittals.

J. Project Record Documents:
   1. Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
   2. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
   3. Concrete Placement: Date and time of each placement as provided in the placement schedule. Include start and end times, temperatures, humidities, and wind velocities.
   4. Test Cylinders: Cross-reference to placement record entries

1.08 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with ICC (IBC) Chapter 19.
   1. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.

B. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

E. Installer Qualifications: A qualified installer who employs on the Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

F. 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 shall be certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities." The certificate shall indicate that the plant has automatic batching and recording capabilities such that requirements of CBC 1705.3.3.1 are met.

G. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, 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.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

H. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

I. Pre-installation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
   e. Special concrete finish subcontractor.
2. As applicable to the Work, review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures and concrete protection.

J. Mock-up
1. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish as result of formwork.
   a. Panel Size: Sufficient to illustrate full range of treatment.
2. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.
3. Mock-up may not remain as part of the Work.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

C. Warrant concrete floor sealer to be free from manufacturing defects for a period of 15 years. Applications completed by an approved installer in accordance with published technical data will be warranted for the suppression and control of water vapor emission, alkalinity, and relative humidity from concrete during the warranty period.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of ASTM C595/C595M for packaging and marking for cement delivery.

PART 2 PRODUCTS

2.01 GENERAL

A. Regulations: Refer to Section 014533 regarding compliance with applicable codes and regulations.

B. Comply with ACI 301 and ACI 318 for interpreting design requirements of reinforced concrete.
   1. Contractor shall keep a copy of ACI Field Reference Manual MNL-15(16) in the field office.

C. Comply with, regulations of the air quality management district in force at the time of the performance of the work of this Section regarding sealers and curing compounds.

D. Finish concrete surfaces shall be stable, firm, and in compliance with CBC Section 11B-403 requirements for slip resistance.
   1. Concrete paving shall have a minimum slip resistance coefficient of friction of 0.6 as tested in accordance with ASTM D2047.
   2. Refer to Part 3 for non-slip finish procedures at exterior concrete platforms, steps, and ramps.

E. Sloping Floors:
   1. The running slope of walking surfaces shall not be steeper than 1:20.
   2. The cross slope of walking surfaces shall not be steeper than 1:48.
   3. At plazas where there is no dominant direction of travel, and at turns, slope shall not exceed 1:48 in any direction.

2.02 FORMWORK

A. Comply with requirements of Section 031000.

2.03 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 032000.

2.04 CONCRETE MATERIALS

A. Hydraulic Cement: Type as indicated on drawings
   1. Acquire cement for the entire project from the same source
   2. Color: Standard Gray UNO.

B. Normal Weight Aggregates: ASTM C33/C33M and CBC 1909.2.1.
   1. Aggregate shall be nonreactive as determined by one of the methods in ASTM C33/C33M Appendix XI: Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate.
   2. Fine Aggregate: Washed natural sand consisting of hard particles, containing not more than the maximum limits of deleterious material allowed by Table 1 of ASTM C33/C33M.
      a. Fineness modulus shall be in the range of 2.90 to 3.10.
   3. Coarse Aggregate, Structural Concrete:
      a. Clean washed gravel or sound crushed rock, containing not more than 5 percent flat, thin, elongated, or laminated material, and containing not more than the maximum limits of deleterious material allowed by Table 3 of ASTM C33/C33M for moderate weathering regions.
         1) Grade 1-inch aggregate from No. 100 sieve to 1 inch.
         2) Grade 1-1/2-inch aggregate from No. 100 sieve to 1-1/2 inches.
      b. Maximum Size: As indicated on drawings and as noted below.
         1) Aggregate shall be no larger than:
            (a) 3/4 of the clear space between reinforcing bars or between reinforcing bars and forms
            (b) 1/5 of the narrowest dimension between sides of forms
            (c) 1/3 of the depth of slab.

2) 3/8" aggregate may be utilized at areas of congestion only when submitted for review, indicating specifically where intended use will be, and approved by the architect.
3) Pea Gravel shall not be used.

4. Acquire aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.
1. Provide lightweight aggregates having a loss of not more than 8 percent when tested by sodium sulfate solution and a loss of not more than 10 percent when tested by magnesium sulfate solution in accordance with ASTM C 88
2. Maximum Size: 3/4 in or as noted below.
a. Aggregate shall be no larger than:
1) 3/4 of the clear space between reinforcing bars or between reinforcing bars and forms
2) 1/5 of the narrowest dimension between sides of forms
3) 1/3 of the depth of slab.

D. Fly Ash: ASTM C618, Class C or F.

E. Slag Cement: ASTM C989/C989M

F. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

G. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.

H. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.05 ADMIXTURES

A. General:
1. Admixtures and additives shall be reviewed by architect prior to use.
2. Admixtures and additives shall be incorporated and tested in accepted combinations and mixes
3. Admixtures containing chlorides will not be permitted.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
1. Manufacturers:
a. Euclid Chemical Company; PLASTOL 6420: www.euclidchemical.com/#sle.
b. Master Builders Solutions; MasterRheobuild 1000: www.master-builders-solutions.com/en-us
c. Substitutions: See Section 016000 - Product Requirements.

D. Water Reducing Admixture: ASTM C494/C494M Type A.
1. Water reduction: Not less than 5%.
2. Increase in compressive strength: Not less than 10% at 28 days.
3. Dry Shrinkage: Less than concrete without admixture at 21 days.
4. Manufacturers:
a. Euclid Chemical Company; EUCON NW: www.euclidchemical.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.

E. Shrinkage Reducing Admixture:
1. ASTM C494/C494M, Type S.
2. Manufacturers:
a. Euclid Chemical Company; Eucon SRA Floor: www.euclidchemical.com/#sle.
b. Euclid Chemical Company; Eucon SRA-XT: www.euclidchemical.com/#sle.

c. Substitutions: See Section 016000 - Product Requirements.

F. Plasticizer: ASTM C494/C494M , Type F

2.06 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Min 15 mils thick, reinforced high density polyethylene sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. Water Vapor Permeance: 0.02 Perms maximum, in accordance with ASTM E154/E154M Section 7.
   2. Puncture Resistance: 2200 grams minimum, in accordance with ASTM D1709 Method B.
   3. Tensile Strength: 45 lbf/in minimum, in accordance with ASTM E154/E154M Section 9, Method ASTM D882.
   4. Installation: Comply with ASTM E1643.
   5. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   6. Manufacturers: Comply with ASTM C755
      a. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
      b. Stego Industries, LLC: www.stegoindustries.com/#sle.
      c. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

B. Subslab Waterproofing (At Floor Slabs Subject to Minor Hydraulic Moisture Pressures): Vapor barrier under slab on grade with hydraulic moisture pressures or wet soils.
   1. Reinforced high density polyethylene (HDPE), mylar geomembrane, or 1/8-inch thick pre-molded membrane having the following minimum properties:
      a. Water Vapor Permeance: 0.005 Perms maximum, in accordance with ASTM E96/E96M.
      b. Water Vapor Barrier Classification: Class A, in accordance with ASTM E1745.
      c. Puncture Resistance: 2400 grams minimum, in accordance with ASTM D1709 Method B.
      d. Tensile Strength: 70 lbf/in minimum, in accordance with ASTM E154/E154M Section 9, Method ASTM D882.
   2. Accessory Products: Provide vapor proofing mastic, pipe boots, and related accessory products recommended by manufacturer of vapor retarder.
   3. Manufacturers: Comply with ASTM C755.
      a. Alumiseal Corporation; Alumiseal Zero Perm Vapor Barrier.
      b. Reef Industries; Griffolyn VAPORguard.
      c. Stego Industries, LLC; Stego Wrap 15-Mil Class A Vapor Barrier.
      d. Substituitions: See Section 016000 - Product Requirements
   4. Seam Tape:
      a. High density reinforced polyethylene vapor retarding seam tape with pressure sensitive adhesive as recommended by manufacturer of vapor retarder/barrier. Minimum 4 inches in width and of a contrasting color.
   5. Non-Shrink Cementitious Grout:
      a. Non-Shrink Grout: Prepackaged, non-metallic, non-gaseous, aggregate grout complying with ASTM C1107/C1107M. Contractor shall select type for each special application as recommended by manufacturer.
      b. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: As indicated on the Contract Drawings.
      c. Flowable Products:
         1) Euclid Chemical Company; NS GROUT: www.euclidchemical.com/#sle.
         2) Five Star Products, Inc; Five Star Fluid Grout 100: www.fivestarproducts.com/#sle.

3) The QUIKRETE Companies; QUIKRETE® Exterior Use Anchoring Cement: www.quikrete.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.

d. Low-Slump, Dry Pack Products:
1) Euclid Chemical Company; DRY PACK GROUT: www.euclidchemical.com/#sle.
2) Five Star Products, Inc; Five Star Grout: www.fivestarproducts.com/#sle.
3) The QUIKRETE Companies; QUIKRETE® FastSet™ Non-Shrink Grout: www.quikrete.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.

6. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator.
a. Minimum Compressive Strength at 7 days, ASTM C579: 12,000 pounds per square inch.
b. Manufacturers:
1) Euclid Chemical Company; E3-DEEP POUR: www.euclidchemical.com/#sle.
2) Five Star Products, Inc; Five Star DP Epoxy Grout: www.fivestarproducts.com/#sle.
3) Five Star Products, Inc; Five Star HP Epoxy Grout: www.fivestarproducts.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.

7. Patching Mortar:
a. Provide Polymer modified portland cement mortar. Compressive strength shall equal or exceed compressive strength of substrate concrete.
b. Mortars shall conform to ASTM C928.
c. Manufacturers:
1) Horizontal Application:
(a) Durapatch Industrial, manufactured by L&M Construction Chemicals.
(b) Embeco R310, manufactured by BASF Admixture Systems.
(c) ProSpec Vinyl Concrete Patch, as manufactured by Bonsal American.
2) Vertical and Overhead application: equal to:
(a) Durapatch VOH, manufactured by L&M Construction Chemicals.
(b) Emaco R350, manufactured by BASF Admixture Systems.
(c) ProSpec Vertical Leveling Mortar, as manufactured by Bonsal American.

8. Floor Leveling Compound: Two-part acrylic polymer latex concrete with compressive strength as tested by ASTM C109/C109M equal or greater than substrate concrete compressive strength.
a. Manfacturers:
1) Ardex; K-15.
2) L&M Construction Chemicals; Levelex.
3) Maxxon Corporation; Level-Right Plus.
4) Substitutions: See Section 016000 - Product Requirements

9. Floor Patching Materials:
a. Patching Materials shall match or exceed compressive strength of the substrate concrete.
1) Interstate Epoxy Patching Compound.
2) Sakrete Fast Setting Cement Patcher.
3) ProSpec Floor Patch Pro, manufactured by Bonsal American.

10. Skim Coat: Blended compound of portland cement, graded silica aggregates, and special chemical additives formulated for bonding, smoothing, rubbing, and thin coating concrete surfaces.
a. Pavecrete manufactured by Lyons Manufacturing or Rapid Set WunderFixx manufactured by CTC Cement.
b. Bonding Agent: Manufacturer's Type II acrylic bonding agent, when applicable. Do not use PVA Type I bonding agents.

c. Pigment: SGS ColorFlo Liquid iron oxide color pigments, as manufactured by Solomon Colors, or equal, in accordance with ASTM C 979.
d. Admixture: Chromix-L manufactured by L.M. Scofield Products, or equal product manufactured by Davis Colors.

11. Isolation Joint Sealant: Provide polyurethane type compatible with fiber joint filler.

2.07 BONDING AND JOINTING PRODUCTS

A. Chemical Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II. Agent shall be freeze-thaw resistant and suitbable for brush or spray application.
1. Manufacturers:
a. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com/#sle.
b. Larsen Products Corp.; Weldcrete.
c. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.
d. W. R. Meadows, Inc; ACRY-LOK-: www.wrmeadows.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.

B. Waterstops: Rubber, complying with COE CRD-C 513.
1. Configuration: As indicated on drawings.
2. Size: As indicated on drawings.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

D. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

2.08 CURING AND SEALING MATERIALS

A. Floor Liquid Curing Compound Type FCC: For use on concrete slabs that will be exposed with separately applied floor sealer finish, or on slabs that will be covered by breathable floor coverings or mortar beds.
1. Compound shall be a water-based non-staining dissipating, translucent resin, conforming to ASTM C309, Type 1, Class B.
a. Sodium silicate compounds will not be permitted.
2. Product shall be compatible with subsequently applied toppings (sealers, hardeners, finishes, or coverings).
3. Manufacturers:
a. Euclid Chemical Co,; Kurex Vox.
b. L&M Construction Chemicals; L&M Cure R.
c. Sonneborn Building Products; Sonosil.
d. W.R. Meadows; Sealtight 1100 Clear.
e. Substitutions: See Section 016000 - Product Requirements

B. Curing Barriers:
1. Waterproof Curing Paper: Conform to ASTM C171, non-staining reinforced type.
a. Manufacturer:
1) Fortifiber Corporation; Orange Label Sisalkraft.
2. Reinforced Curing Barriers: Transguard 4000 manufactured by Reef Industries or equal.

C. Floor Remedial Vapor Emission and Alkalinity Control Sealer Type FCS: For remedial use on concrete slabs on grade that do not meet manufacturer's specific moisture emission and alkalinity limits for non-breathable floor finishes.
1. Manufacturers:

a. Sinak Corporation; Sinak VC5: www.sinak.com.
b. Bonsal American; ProSpec Moisture Guard Max.
c. Synthetics International; Synthetic30 two-component liquid-applied, waterborne polymer-based ultra-low viscosity clear sealer. www.syntheticsintl.com.
d. Substitutions: See Section 016000 - Product Requirements

D. Floor Sealer Finish Type FSF: For general use at exposed concrete slab areas for appearance.
1. Design is based on the use of high solids, minimum 25% non-yellowing water-based acrylic cure/sealer conforming to ASTM C309, Type 1, Class B and ASTM C1315, Type 1, Grade B, low VOC compliant meeting all local air quality regulations.
2. Product shall be in compliance with volatile organic compounds (VOC) content limits required by air quality management district at the time of performance of the work.
3. At Exposed Concrete Surfaces at Garage Areas:
a. Compound shall be a water-based non-staining dissipating, translucent resin, conforming to ASTM C309, Type 1, Class B.
4. Sodium silicate compounds will not be permitted.
5. Manufacturers:
a. Euclid Chemical Co.; Euclid Aqua Cure VOX Super.
b. L&M Construction Chemicals; Dress & Seal WB30.
c. W.R. Meadows; VOComp 25.
d. Sinak Corporation; HLQ-125.
e. Substitutions: See Section 016000 - Product Requirements

E. Wall Sealer and Water Repellent Finish Type WSR: For general use at exposed concrete wall surfaces in Restrooms for code compliance.
1. Design is based on the use of a modified neat silane repellent system offering invisible protection and low volatility combined with water and oil repellency on concrete substrates to prevent staining by waterborne and oily substance.
2. Product shall be in compliance with volatile organic compounds (VOC) content limits required by air quality management district at the time of performance of the work.
3. Manufacturers:
a. Miracle Sealants Co.; 511 Impregnator.
b. Prosoco, Inc.; Stand Off SLX100 Water & Oil Repellent.
c. Substitutions: See Section 016000 - Product Requirements.

2.09 CONCRETE MIX DESIGN

A. Global Warming Potential (GWP) Limit: As Indicated, per mix
1. Exception: Concrete may be considered one product category. A weighted average of the maximum GWP for all concrete mixes installed in the project shall be less than the weighted average maximum GWP specified on the structural drawings. Calculation shall be submitted to the Architect (Engineer) for approval

B. Mix design shall be stamped and signed by a professional engineer licensed in the State of California.

C. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

D. Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.

E. The proportioning of ingredients shall be such that the concrete can be readily worked into forms and around reinforcement under the conditions of placement to be used, without segregation or excessive bleeding.

F. Concrete Compressive Strengths: Provide compressive strengths as noted on drawings, when tested in accordance with ASTM C39/C39M at 28 days.

1. Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
    a. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

G. Fly Ash or other pozzolans Content: Maximum 25 percent of cementitious materials by weight.

H. Total of fly ash or natural pozzolans and silica fume: Maximum 35 percent by weight.

I. Total of fly ash or natural pozzolans slag cement and silica fume: Maximum 50 percent by weight.

J. Water-Cementitious Material Ratio: As indicated on the Contract Drawings
1. Slabs-on-Grade: Water to cement content shall not exceed a ratio of 0.42 upon delivery at site.
2. Other Concrete Not in Contact with Soils: Water to cement content shall not exceed a ratio of 0.45 upon delivery to site.

K. Maximum Slump: As indicated on the Contract Drawings

L. Accurately control the proportions, water content, and air content. Use weighing equipment accurate to within 1 percent for cement and 2 percent for aggregates, and adjustable for varying aggregate moisture content. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment.
1. Proportion concrete by weight of loose, dry material.
2. Fine aggregate volume shall be at least 35 percent of the sum of the separate fine and coarse aggregate volumes.

M. Admixtures: Admixtures may only be used if they are incorporated into the accepted concrete mix designs and testing. Where admixture is proposed for use by concrete supplier, conform to types accepted by Architect in writing.
1. Proposed admixtures shall be as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

N. Fiber Reinforcement: Add to mix at rate indicated on drawings and in accordance to manufacturer's instructions. Provide uniform and complete distribution based on manufacturer's recommendations.

O. Tests for Concrete Materials at Batch Plant: Utilizing batch plant test records, perform the following tests in accordance with provisions of the building code:
1. Cement: Sample and test cement, or provide mill test reports, as accepted, certifying that the cement conforms to the requirements of this Specification.
2. Aggregate:
    a. Sample and test concrete aggregate for grading and soundness before concrete mix designs are established.
    b. Test aggregate for shrinkage characteristics in accordance with ASTM C157/C157M.
    c. Conduct petrographic examinations of aggregate proposed for use in accordance with ASTM C295/C295M.
3. Air Content: ASTM C173/C173M, volumetric method or ASTM C231/C231M, pressure method. One test for each set of compressive strength test specimens.
4. Refer to "Field Quality Control" in Part 3 for testing of actual concrete mix and placement.

P. Inspection: Accompany each load of materials or concrete with a signed copy of batch plant's certificate stating quantity of each material, design strength, amount of water added at plant, admixtures, departure time and date, and maximum amount of water allowed to be added at site.

Q. Shrinkage Test:
1. Before placing any concrete, prepare a trial batch of the mix design, using the same aggregates, cement, and admixtures (if any) proposed for use on the project. Prepare at least three specimens for determining the drying shrinkage of the mix design.

2. The drying shrinkage specimens shall be 4"x4"x11" prisms, made, cured, dried, and measured as specified in ASTM C157/C157M7. Measure and report separately for 7, 14, 21, and 28 days of drying. After 7 days of moist curing. The effective gauge length of the specimens shall be 10 inches.
3. The average drying shrinkage of the test specimens after 28 days of drying shall not exceed 0.045 percent for footing and grade beams, and 0.035 percent for all other locations. Use adequate amount of shrinkage reducing admixture as required.

2.10 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M and ASTM C94/C94M.
   1. For mixer capacity of 1 cu. yd. (0.76 cu. m) 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 mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 60 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.
   4. Colored Concrete: Add pigments in strict accordance with manufacturer's instructions to achieve consistent color from batch to batch.
   5. Fiber Reinforcement: Batch and mix as recommended by manufacturer for specific project conditions.

B. Transit Mixers: Comply with ASTM C94/C94M.
   1. With each load, provide ticket certifying the materials and quantities as well as compliance with the accepted mix design.

C. On the transit mix ticket, state the time water was first added to the mix.
   1. At the batch plant, withhold 2-1/2 gallons of water per cubic yard of concrete.
   2. Upon arrival at the job site, as directed by the Testing Laboratory Inspector, add all or part of the withheld water before the concrete is discharged from the mixer.
   3. Mix concrete for not less than 5 minutes after the withheld water has been added, and not less than 1 minute of that time immediately prior to discharge of the batch.
      a. Drum shall rotate approximately 70 to 100 revolutions at a mixing speed of approximately 6 to 18 rpm.
      b. After mixing, drum shall rotate at an agitating speed of approximately 2 to 6 rpm.
      c. Unless otherwise directed, provide 15 minutes total mixing per batch after first addition of water.
   4. Discharge of the concrete shall be completed within 90 minutes after water is introduced into the mix, or before the drum has completed 300 revolutions.

D. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

E. Weather Requirements:
   1. Hot Weather Usage: Adjust mix as required to counteract effects of anticipated or probable hot weather on strength of concrete. Conform to recommendations of ACI 305R regarding admixtures, temperature of mixing water, and delivery times.
      a. During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection and curing to prevent excessive concrete temperatures or water evaporation that may impair required strength or serviceability of the member or structure.

b. When air temperature is between 85 degrees F. and 90 degrees F, limit mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F, limit mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to performing work and placing concrete, verify:
   1. Lines, levels, and dimensions before proceeding with work of this section.
   2. Elevations and depressions of floor finishes
   3. Final excavation required for foundations and footings prior to placing concrete.
   4. Locations of proposed and future breathable and nonbreathable floor finishes in advance of placing concrete to determine type of floor sealers to be applied in finishing operations.
   5. Formwork is properly located such that the unshored concrete will maintain specified tolerances after forms are removed.

3.02 PREPARATION

A. Formwork: Comply with Section 031000 - Concrete Forming and Accessories.

B. Reinforcing: Comply with Section 032000 - Concrete Reinforcing.

C. Verify that forms are clean and free of rust before applying release agent.

D. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning, roughening to exposed aggregate, and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use latex bonding agent only for non-load-bearing applications.

F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade over properly prepared subbase per Geotechnical recommendations. Lap joints minimum 6 inches. Tape and seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
   1. Place Slab on Grade directly on vapor retarder.
   2. Avoid grade staking through vapor retarder.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.
   1. Pour concrete in accordance with accepted pour schedule and construction joint layout.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 48 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously between predetermined construction joints per ACI and CBC requirements. Where construction joints are located, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

H. Compacting:
   1. General: Spade, rod, vibrate, and consolidate concrete in forms. Vibrators shall not be left in any one spot longer than 30 seconds and shall be kept constantly in motion. One vibrator shall be assigned to each location where concrete is being placed and a standby vibrator shall be kept ready at all times. Avoid creating rock pockets, air bubbles, honeycomb, or separation of ingredients.
   2. Work concrete thoroughly around reinforcement and embedded items and into corners and angles of forms by spading, rodding, and tamping.
   3. Consolidation: Vibrate to consolidate each layer with previously placed layers, completely embedding reinforcing and fixtures, and bringing fine material to surface of slab to produce proper finish.

I. Hot Weather Placing: Comply with recommendations of ACI 305R.

J. Cold Weather Placing: Comply with recommendations of ACI 306R.

3.04 GROUTING

A. Non-Shrink Grout: Install non-shrink grout per drawing properly beneath bearings of plates, columns, and other structural members using product recommended by manufacturer for specific application and in accordance with printed instructions.
   1. Compressive strength of grout shall be tested in accordance with ASTM C109/C109M .

3.05 CONTROL AND CONSTRUCTION JOINTS

A. Control Joints:
   1. Location: As indicated on the Contract Drawings, but not more than 20 feet on centers in both directions at exterior slabs. Limit interior slabs on grade to 400 square foot bays with length to width ratios of 1 to 1.5 maximum.
      a. Locate on column center lines and at re-entry corners wherever practical.
      b. Avoid areas receiving tile or paver floor finish.
      c. Coordinate locations with proposed floor finish joint layout.
      d. Limit length to width ratios to 1 to 1.25.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; with width and depth as indicated on drawings.
   1. Fill saw cuts in interior walkways with control joint filler specified.

E. Construction Joints:
   1. Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:
   2. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.
   3. A mix containing the same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.
   4. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

3.06 SEPARATE NON-STRUCTURAL FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Non-structural toppings slabs shall be normal-weight concrete, reinforced as noted on the Contract Drawings.

D. Place concrete floor toppings to required lines and levels.
   1. Place topping in checkerboard panels not to exceed 20 feet in either direction.

3.07 TOLERANCES FOR CONCRETE CONSTRUCTION AND MATERIALS

A. An independent testing agency, as specified in Section 014000, will inspect finished slabs for compliance with specified tolerances.

B. Conform to requirements of ACI 117, except as modified by the requirements of these Specifications and CBC.

C. Formed Surfaces:
   1. Maintain bowing, warping, and dimensional tolerances within the maximum tolerances stated in ACI 117 for Class A surfaces.
   2. Overall Dimension for Height and Width: Plus zero to minus 3/32-inch for surfaces that are 10 feet and over.
   3. Thickness: Plus-or-minus 1/8-inch maximum.
   4. Openings: Accurate to within a tolerance of plus 1/8-inch to minus zero.
   5. Exposed Slab Edges: Free of jogs exceeding 1/8-inch.

D. Concrete Slabs: Floor finish tolerances shall be measured in accordance with ASTM E1155 and ACI 302.1R the F-Number System (Inch-Pound Units) for the following conditions:

Element	Specified Overall Value		Minimum Local Value	
	FF	FL	FF	FL
Slab-on-Grade:				
Mech and Electrical Rooms, parking structures	20	15	15	10
Carpeted	25	20	17	15
Thinset Tile, Resilient Flooring	35	25	24	17
Wood Flooring	50	35	35	35
Other not indicated	35	25	24	17
Suspended Slabs:				
Mechanical and Electrical Rooms, parking structures	20	15 (SHORED)	N/A	N/A
Carpeted	25	20 (SHORED)		
Thinset Tile, Resilient Flooring	35	25 (SHORED)		
Wood Flooring	50	35 (SHORED)		
Other not indicated	35	25 (SHORED)		

E. Verify flatness requirements in accordance with Owner's specification requirements prior to installation.

F. Suspended Slab Levelness: Where FL is not specified (unshored conditions) floors must be level, and the elevation of the top surface shall fall within a 3/4-inch envelope in accordance with ASCC Tolerances for Suspended Concrete Slabs, unless part of a sloping floor or as otherwise noted.

G. Concrete Door Sills:
   1. Slabs Under Operable Partitions or Sound-Rated Accordion Doors: 1/8-inch from level along line under partition or door.
   2. Slabs Under Roll-up Doors: 1/8-inch from level along line under partition or door.

H. Levelness tolerances shall be measured within 72 hours after slab concrete placement.
   1. Tolerances for sloped floors shall not exceed the slopes specified in "REGULARTORY REQUIREMENTS" in Part 2.

I. Owner reserves the right to test floors and concrete members for conformance to ACI 117 by Use of the Dipstick Floor Profiler. Should tolerances not be within the limits specified, the Contractor shall be required to pay the cost of the tests, as well as the repairs required to bring work into compliance.

J. Corrective Procedures: See "FILLING, LEVELING AND PATCHING."
   1. Areas requiring corrective work should be identified and submitted to Architect. Re-measure corrected areas by the same process.

3.08 CONCRETE FINISHING

A. Formed Concrete
   1. Surface Repairs: Repair surface defects, including defective areas and tie holes as recommended in ACI 301 Section 2 or 6.
   2. Rough-Formed Finish: Cast concrete texture imparted by form-facing material, not arranged in any specific visual manner. Repair and patch tie holes and defective areas. Rub down or chip off fins and other projections exceeding 1/4-inch in height.
      a. Apply to concrete surfaces not exposed to public view.
   3. Smooth-Formed Finish: Cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.
      a. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, damp-proofing, veneer plaster, or painting.
      b. Apply the following rubbed finish, defined in ACI 301 Section 6, to smooth-formed finished concrete.
         1) Grout-cleaned finish.
         2) Smooth-rubbed finish.
   4. Painted Finish: Entire surface area exposed to view shall be free of voids, cracks, spalls, protrusions, or non-uniform textures.
      a. Prior to sacking, prepare surfaces in accordance with Section 099113 - Exterior Painting and Section 099123 - Interior Painting as applicable.
      b. Entire surface area of concrete exposed to view shall be repaired, resurfaced, and made ready to receive paint finish specified under Section 099113 - Exterior Painting and Section 099123 - Interior Painting as applicable.
         1) Resurfacing of concrete panel surfaces shall be accomplished with specified resurfacing materials in accordance with manufacturer's instructions and the preparation and application procedures of ACI 503.4.

c. Interior surfaces at window openings shall be ground smooth, resurfaced, and prepared to receive sealants.
   1) Resurface concrete sills, jambs, and heads with specified resurfacing, patching, and finishing materials in accordance with manufacturer's instructions.
      (a) Interior surfaces at openings shall be ground smooth, resurfaced, and prepared to receive sealants.
d. Finish repaired surfaces with primer and two coats of paint finish as specified under Section 099113 - Exterior Painting and Section 099123 - Interior Painting as applicable.

5. Related Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
6. Electrostatic Coatings: Install in accordance with manufacturer's printed instructions.
7. Patching and Skim Coating: Refer to "FILLING, LEVELING AND PATCHING."

B. Flatwork
1. Screeding: Work out irregularities and bring surfaces to true finish grade or elevation. Remove excess water and debris worked to the surface during compaction and screeding.
2. Initial Troweling:
   a. Do not commence troweling until surface water sheen has disappeared.
   b. Use wood bullfloats to open top of slab to allow bleed water out.
   c. Do not use metal floats.
   d. Do not apply dry cement, sand, or water to surface.
   e. Slabs to Receive Mortar-bed with Topping or Bonded Finish: Upon completion of pour, and before concrete has hardened, texture surface of slab with stiff broom, or roughen surface.
   f. Slabs to Receive Crack Isolation Membrane or Mortar-bed with Cleavage Membrane: Finish slabs with typical smooth troweled surface.
3. Final Troweling:
   a. Interior Slabs: Steel trowel and burnish.
      1) Do not finish slab until bleed water has evaporated.
      2) Do not apply water to the concrete during finishing.
      3) Do not allow rainwater to stand on slab.
   b. Sills and Other Weather Surfaces: Smooth trowel and burnish. Finish external angles uniform and tooled.
   c. Sealer: Where specified, apply in accordance with the requirements of Section 033511.
4. Finish for Interior Stairs:
   a. Sprinkle abrasive aggregate uniformly on unhardened surface immediately prior to finishing, at the rate of 2 pounds per square yard. Work into surface during finishing. Rub lightly to expose abrasive aggregate while concrete is green.
   b. Concrete walking surfaces shall have a minimum slip resistance coefficient of friction of 0.6 as tested in accordance with ASTM D 2047.
   c. Stairs: Apply grooves and tooled edges to tread nosing in accordance with the Contract Drawings.
      1) Provide medium broom finish.
   d. Warning Stripes: Apply 2-inch wide warning stripe of 70 percent contrasting color at top and bottom nosing of each run at interior stairs, 1 inch maximum from edge of nosing.
   e. Pedestrian, General:
      1) Provide medium broom finish.
      2) Medium acid etch finish.
5. Float Finish:

a. After screeding, consolidating, and straightening concrete slabs, do not work surface until ready for floating.
b. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats. The application of Portland cement to slab during floating or troweling is prohibited.
c. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and frill low spots. Repeat float passes and straightening until surface is left with a uniform, smooth, granular texture.
d. Finish to straightedge tolerance.
e. Cut down high areas and fill in low areas.
f. After straightening, refloat surface to uniform, smooth, granular texture.
g. Locations:
1) Surfaces scheduled for trowel and broom finishes.
2) Surfaces scheduled to receive adhered roofing or waterproofing membrane.
3) Surfaced scheduled to receive thick-set mortar beds on cleavage membrane.

6. Trowel Finish:
a. After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
b. Finish to straightedged tolerance.
c. Locations:
1) Surfaces scheduled to receive thin-set mortar beds, resilient flooring, carpet, and wood flooring.
2) Exposed surfaces.
3) Surfaces scheduled to receive paint or other thin film finish coating.

7. Medium Broom Finish:
a. Provide float finish and let set.
b. While surface is still plastic draw medium stiff fiber bristle broom uniformly over surface to provide texture perpendicular to main traffic direction.
c. Locations:
1) Stair treads.

8. Heavy Broom Finish:
a. Provide float finish and let set.
b. Texture: While surface is still plastic, swirl stiff fiber bristle broom uniformly over level surfaces and perpendicular to main traffic direction at ramp surfaces.
c. Locations:
1) Parking garage areas.

9. Acid Wash: Top-Cast No. 3 Light Etch.
a. Provide acid containment area and comply with CAL OSHA for application and cleanup.
b. First Wash: Three days after pour.
c. Second Wash: Three weeks after first application.
d. Third Wash: At time of final completion of Project.
e. Appearance: Slab surfaces shall exhibit an aggregate exposure of fine aggregate particles constituting not less than 60 percent and not more than 80 percent of the surface, as directed by Architect. Exposure shall be of sufficient depth to provide a surface profile of between 1/16-inch and 3/16-inch.

10. Electrostatic Control Coating: Install in accordance with manufacturer's recommendations.

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:

1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.09 SEALING

A. Formed Concrete Surface:
   1. Interior Vertical Surfaces: Where indicated on Contract Drawings, treat vertical surfaces of interior exposed formed concrete with specified sealer finish Type WSR.
      a. Apply protective treatment in saturating applications without atomizing the product. Use enough to thoroughly wet the surface and create a slight rundown below the spray pattern. Apply uniformly. Don't over apply.
         1) Provide two applications of protective treatment at exposed concrete toilet room wall locations. Apply the second coat within a few minutes after the first coat has penetrated and appears dry; do not atomize the product during application.
      b. Brush heavy runs and drips thoroughly into the surface.
      c. Protect treated surfaces from contact or by water or for 4 hours.
   2. Exterior Vertical Surfaces: Where indicated on Contract Drawings, treat vertical surfaces of exterior exposed formed concrete with sealer in accordance with specified sealer finish Type FSF.

B. Flatwork
   1. Grind and clean floors prior to sealing.
   2. Sealer/Dustproofer:
      a. Prepare substrates and spray apply curing sealer in accordance with manufacturer's directions.
      b. Locations:
      c. Mechanical rooms, main trash room, electrical rooms, and telephone rooms.
      d. Other locations where indicated or scheduled in Contract Drawings.
   3. Penetrating Sealer:
      a. Sealed Concrete Type SC2: Polish with clear finish in accordance with Section 033513 - High-Tolerance Concrete Floor Finishing.

3.10 CURING

A. Comply with requirements of ACI 308R and ACI 318. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than seven days.

C. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.

D. Surfaces Not in Contact with Forms:
   1. Curing Compound: Cure by completely and uniformly applying liquid curing compound in accordance with manufacturer's printed instructions. Apply at least two coats at right angles to each other.
      a. Reapply curing membrane at saw cut joints and at exposed edges of slab after removal of forms.
      b. Omit curing compound and use moisture curing where required to provide floor sealer.
      c. Omit curing compound where curing/sealing compound specified provides a concurrent curing function and is applied at the time of concrete placement appropriate to such function.

d. Slabs and floors to receive adhesive-applied flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Continuous Moisture: Cure by keeping concrete continuously wet for a period of at least 7 days after pouring in accordance with ACI 308R and ACI 318 for curing interior slabs to receive flooring finishes. During periods of high temperature, low humidity, or wind, wet concrete as often as required to keep concrete continuously moist for a period of at least 10 days. Cover with waterproof curing paper or reinforced vapor retarder, maintaining a film of water.
3. Final Curing: Begin after initial curing but before surface is dry.

E. Ambient Conditions:
1. Hot Weather Curing:
2. Conform to recommendations of ACI 305R regarding curing of concrete flatwork in hot weather.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed testing agency.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Testing:
1. Sample fresh concrete in accordance with ASTM C172/C172M, except modified for slump to comply with ASTM C94/C94M.
2. Slump: Test will be performed in accordance with ASTM C143/C143M. One test will be made for each concrete load at point of discharge and one test for each set of compressive strength test specimens.
3. Concrete Temperature: Test will be taken hourly when air temperature is 40 degrees F or below, and when 80 degrees F or above, and each time a set of compression test specimens is made.
4. Curing: Cure specimens in accordance with ASTM C31/C31M.
5. Frequency of Compressive Strength Testing: Test will be made in accordance with ASTM C39/C39M, ACI 318, CBC Chapter 19, and Table 1705.3.
   a. Test one set of four cylinders for each concrete class placed in any one day for each 50 cubic yards or fraction thereof, or for each 2000 square feet of surface area placed. One specimen will be tested at 7 days, two at 28 days, and:
      1) When frequency of testing will provide less than five strength tests for a given class of concrete, testing from at least five randomly selected batches, or from each batch if fewer will be conducted.
   b. If the average of strength tests of all strength tests of a given class of concrete equals or exceeds the specified strength at 28 days, with no individual strength test less than 500 psi below that specified, the strength level of concrete will be considered satisfactory.
   c. Retain one cylinder for testing at 56 days if 28-day test fails.

E. Moisture Vapor Emission Testing: After concrete slabs have cured and prior to installation of finish flooring materials, verify that moisture content and alkali content of concrete slabs do not exceed limits acceptable to manufacturer of flooring materials.

1. Testing Equipment: Test methods based on ASTM F2170 using RH meters and testing kits equal to AMT Moisture/Relative Humidity Meter manufactured by American Moisture Test, Inc., or equivalent by Vaprecision Testing Systems may be used at testing agency's option except at concrete floors with exposed or polished finish.
2. Alkalinity: Concrete pH test using calibrated digital 1-14 wide range pH meter equal to PH100 to determine alkalinity level in accordance with ASTM F710. Paper and pencil type tests are not acceptable.
3. Calcium Chloride Testing: After building air conditioning has been in operation for at least 15 days, calcium chloride and pH testing kits may be used: Prepackaged test kit of commercial consistency, equipped with a sealed dish of anhydrous calcium chloride, a metering dome with butyl rubber gasket and instructions for implementation. Weigh dishes on site prior to installation. Conform with requirements of ASTM F1869.

F. Vapor Emission and Alkalinity Testing:
1. Perform vapor emission and alkalinity testing and take appropriate action based on results in relation to finish floor manufacturer's moisture and alkalinity requirements.

G. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.12 FILLING, LEVELING AND PATCHING

A. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired, or as directed by LPA.
1. High spots shall be honed, or ground with power-driven machines to required tolerances with approval from LPA.
2. Low spots shall be filled with floor leveling compound, installed in accordance with manufacturer's written recommendations.

B. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

C. Patching Exposed Concrete: After flushing with water, pack tie wire, nail, bolt, and core sample holes which will be exposed as soon as possible after form removal. Grout and repair rough pockets, cracks, or honeycomb. If patches are required, chip defective areas to a uniform depth of at least 1 inch with sides at right angles to surface.
1. Match surrounding concrete surfaces in color and texture. Make trial patch to determine color match. Before applying, moisten surrounding concrete and apply specified bonding compound.
2. Smooth Formed Concrete: Grind off ridges, offsets, and other prominent marks of smooth formed concrete while concrete is green and grind smooth. Sack exposed concrete surfaces.
   a. Painted concrete shall be considered as being exposed.
3. Patch defects deeper than 1/2-inch in panels with specified patching material and methods deemed by the LPA as the appropriate method to correct such defects.

D. Skim Coating: Where sack and patch is noted on Contract Drawings, apply to architectural formed cast-in-place concrete walls in accordance with manufacturer's instructions.
1. New concrete must be cured 28 days.
2. pH must be verified prior to skim coating application to determine if primer needs to be applied, as required by manufacturer.
3. Clean concrete in accordance with ASTM D4258.
4. Mixing Skim Coat:
   a. Add to water, adding only enough to make a stiff trowelable consistency like soft putty.
   b. Add color additive.
   c. Working Time: Approximately 15 minutes.

5. Apply to walls with trowel in smooth uniform coat in continuous operations to maintain a uniform shade.
6. Patching: Broad deep areas in concrete surface shall be filled with skim coat material in accordance with manufacturer's directions prior to application of skim coat. Where surfaces are shiny smooth, apply manufacturer's Type II bonding agent.

E. Patching Unexposed Concrete: Ridges, offsets, and other prominent marks need not be ground off, cleaned, or sacked. This requirement applies to concrete areas that will be concealed by other construction.
1. Finish below-grade concrete indicated to receive waterproofing in the same manner as exposed, smooth-formed concrete, except that surfaces need not be sacked.
2. Patch and repair concrete slabs ready to receive future finish materials installed by Owner.

3.13 DEFECTIVE CONCRETE

A. Strength
1. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
2. If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, falls below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.
3. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective and shall be evaluated by LPA and replaced or adequately strengthened in a manner acceptable to the LPA and DSA.
4. Test Cores: Should required test cylinders fail to show minimum design compressive strength, take test cores at locations coordinated with the LPA.
a. If results show compressive strength to be less than design stress, concrete shall be deemed defective and shall be replaced in a manner acceptable to the Architect and DSA.
b. If results show compressive strength to conform to design stress, grout solid coring holes with grout exceeding design compressive strength and finish to match adjacent surface.

B. Concrete Work that is not formed as indicated, is not true within tolerances of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, cracked, contains sawdust shavings, wood or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.

C. Concrete substrates for non-breathable floor finishes that indicate by testing excess quantities of moisture and alkalinity shall require remedial measures, as specified in this Section.

D. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing, including patching for cores, shall be borne by Contractor when defective concrete is identified.

E. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.14 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

B. Wash and clean flatwork surfaces. Leave free from oil, paint, plaster, form coating, and other foreign substances, ready to receive scheduled finishes.

3.15 PROTECTION

A. Protect the Work of this section until Substantial Completion.

B. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION 033000

SECTION 055213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stair railings and guardrails.

B. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting: Paint finish.

B. Section 321313 - Concrete Paving

1.03 REFERENCE STANDARDS

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Railings and handrails: CBC Section 11B-505:

1. Top of gripping surfaces of handrails shall be 34 inches minimum and 38 inches maximum vertically above walking surfaces, stair nosings, and ramp surfaces. Handrails shall be at a consistent height above such surfaces.
2. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1-1/2 inches minimum. Handrail may be located in a recess if the recess is 3 inches maximum deep and 18 inches minimum clear above the top of the handrail.
3. Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur 1-1/2 inches minimum below the bottom of the handrail gripping surfaces.
4. Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1-1/4 inches minimum and 2 inches maximum.
5. Handrail gripping surfaces with a non-circular cross section shall have an outside dimension of 4 inches minimum and 6-1/4 inches maximum, and a cross-sectional dimension of 2-1/4 inches maximum.
6. Handrail gripping surfaces and any surfaces adjacecnt to them shall be free of sharp or abrasive elements and shall have rounded edges.
7. Handrails shall not rotate within their fittings.
8. Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs in accordance with CBC Section 11B-505.10. Such extensions are not required for

continuous handrails at the inside turn of switchback or dogleg stairs and ramps.

9. A 2 inch minimum high curb or a barrier shall be provided to prevent the passage of a 4 inch diameter sphere rolling off the sides of a ramp surface. Such a curb or barrier shall be continuous and uninterrrupted along the entire length of a ramp. CBC Section 11B-405.9.2.

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM

A. Steel Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

B. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.04 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. 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.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Anchor railings securely to structure.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055213

SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Restrictions: Additional requirements for sealants and primers.

B. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.03 DEFINITIONS

A. Refer to ASTM C920 for additional information.
   1. Type S: Single-component.
   2. Type M: Multi-component.
   3. Grade P: Pourable or self-leveling, for horizontal applications.
   4. Grade NS: Non-sag or gunnable, for vertical applications.
   5. Class 100/50: Accepts at least 100 percent increase and 50 percent decrease of joint width.
   6. Class 50: Accepts at least 50 percent increase and decrease of joint width.
   7. Class 35: Accepts at least 35 percent increase and decrease of joint width.
   8. Class 25: Accepts at least 25 percent increase and decrease of joint width.
   9. Class 12-1/2: Accepts at least 12-1/2 percent increase and decrease of joint width.
   10. Use T1: Designed for pedestrian and vehicular traffic areas, with a high durometer (hardness).
   11. Use T2: Designed for pedestrian and vehicular traffic areas, with a lower durometer (hardness).
   12. Use NT: Designed for non-traffic areas.
   13. Use I: Designed to be continuously submerged in liquid (immersion service).
   14. Use M: Designed for use with mortar.
   15. Use G: Designed for use with glass. See Section 088000 - Glazing.
   16. Use A: Designed for use with aluminum.
   17. Use O: Designed for use on non-standard (other) substrates.

1.04 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

H. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

J. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

K. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

L. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. Substrates for which laboratory adhesion and/or compatibility testing is required.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. CAL (CDPH SM) compliance data.
   2. VOC content restrictions data.

D. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

E. Sample product warranty.

F. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

G. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

H. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

I. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

J. Installation Plan: Submit at least four weeks prior to start of installation.

K. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

L. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

M. Installation Log: Submit filled-out log for each length or instance of sealant installed.

N. Executed warranty.

1.06 QUALITY ASSURANCE

A. Qualifications: See Section 01 4000 - Quality Requirements.
   1. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   2. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

B. Preinstallation Meetings: See Section 01 3000 - Administrative Requirements.
   1. Convene minimum 2 weeks before starting work of this Section.

C. Mock-ups: See Section 01 4000 - Quality Requirements.
   1. Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   2. Approved mock-ups may remain as part of the completed Work if undisturbed at time of Substantial Completion.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. See Section Section 01 4000 - Quality Requirements, for additional information.
   2. Adhesion Testing: In accordance with ASTM C794.
   3. Compatibility Testing: In accordance with ASTM C1087.
   4. Stain Testing: In accordance with ASTM C1248; required for stone and masonry substrates.
   5. Allow sufficient time for testing to avoid delaying the work.
   6. Deliver sufficient samples to manufacturer for testing.
   7. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
   8. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

E. Installation Plan: Include schedule of sealed joints, including the following:
   1. Joint width indicated in Contract Documents.
   2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
   3. Approximate date of installation, for evaluation of thermal movement influence.
   4. Installation Log Form: Include the following data fields, with known information filled out.
      a. Location on project.
      b. Substrates.
      c. Sealant used.
      d. Stated movement capability of sealant.
      e. Primer to be used, or indicate no primer is used.
      f. Size and actual backing material used.
      g. Date of installation.
      h. Name of installer.
      i. Actual joint width; provide space to indicate maximum and minimum width.
      j. Actual joint depth to face of backing material at centerline of joint.
      k. Air temperature.

F. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.

2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
   a. Test date.
   b. Copy of test method documents.
   c. Age of sealant upon date of testing.
   d. Test results, modeled after the sample form in the test method document.
   e. Indicate use of photographic record of test.

G. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing.

C. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

D. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.08 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or are below 40 degrees F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

2.02 JOINT SEALANTS - GENERAL

A. Color of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

2.03 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
   2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   5. Products:
      a. Dow; DOWSIL 790 Silicone Building Sealant: www.dow.com/#sle.
      b. Dow; DOWSIL 791 Silicone Weatherproofing Sealant: www.dow.com/#sle.
      c. Dow; DOWSIL 795 Silicone Building Sealant: www.dow.com/#sle.
      d. Momentive Performance Materials, Inc/GE Silicones; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant: www.siliconeforbuilding.com/#sle.
      e. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): www.pecora.com/#sle.
      f. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
      g. Substitutions: See Section 01 2500 - Substitution Procedures.
   6. Locations:
      a. Joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints in dimension stone cladding.
      d. Joints in exterior insulation and finish systems.
      e. Joints between metal panels.
      f. Joints between different materials listed above.
      g. Permiter joints between materials listed above and frames of doors, windows, aluminum storefront and curtain wall, and louvers.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant, acid-curing; not expected to withstand continuous water immersion or traffic.
   1. Color: White.

2. Products:
   a. Dowsil; 786 Mildew Resistant.
   b. GE Advanced Materials - Silicones; Sanitary SCS1700.
   c. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com/#sle.
   d. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.
   e. Tremco; Tremsil 200 Sanitary.
   f. Substitutions: See Section 01 2500 - Substitution Procedures.
3. Locations:
   a. Interior sealant joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Interior sealant joints subject to moisture.

C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
1. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
2. Products:
   a. Bostik; Siliconized Acrylic Caulk.
   b. Pecora Corporation; AC-20 +Silicone: www.pecora.com/#sle.
   c. Sherwin-Williams Company; 850A Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
   d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
   e. Substitutions: See Section 01 2500 - Substitution Procedures.

D. Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
2. Service Temperature Range: Minus 13 to 180 degrees F.
3. Products:
   a. Pecora Corporation; Pecora BC-158 Butyl Rubber Sealant: www.pecora.com/#sle.
   b. Sherwin-Williams Company; Storm Blaster All Season Sealant: www.sherwin-williams.com/#sle.
   c. Substitutions: See Section 01 2500 - Substitution Procedures.
4. Locations:
   a. Roof panel rib sealant.
   b. Termination bars.

E. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.
1. Products:
   a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com/#sle.
   b. Tremco Commercial Sealants & Waterproofing; Acoustical/Curtainwall Sealant: www.tremcosealants.com/#sle.
   c. Substitutions: See Section 01 2500 - Substitution Procedures.

2.04 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.

3. Service Temperature Range: Minus 40 to 180 degrees F.
4. Products:
   a. Master Builders Solutions; MasterSeal SL 2.
   b. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
   c. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.
   d. Substitutions: See Section 01 2500 - Substitution Procedures.
5. Locations:
   a. Control and expansion joints in brick pavers.
   b. Isolation and control joints in cast-in-place concrete slabs.
   c. Joints in stone paving units.
   d. Tile control and expansion joints.
   e. Joints between materials listed above.

B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Service Temperature Range: Minus 40 to 180 degrees F.
4. Products:
   a. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.
   b. W. R. Meadows, Inc; POURTHANE SL: www.wrmeadows.com/#sle.
   c. Substitutions: See Section 01 2500 - Substitution Procedures.

C. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids, UV-resistant; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Durometer Hardness, Type A: 85, minimum, after seven days when tested in accordance with ASTM D2240.
2. Joint Depth: Provide product suitable for joints from 1/8 inch to 1 inch in depth excluding space for backer rod.
3. Products:
   a. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: www.ardexamericas.com/#sle.
   b. Euclid Chemical Company; EUCO QWIKjoint UVR: www.euclidchemical.com/#sle.
   c. Metzger McGuire; Edge-Pro.
   d. SASE; FlexJoint 85.
   e. VersaFlex; SL/85.
   f. Substitutions: See Section 01 2500 - Substitution Procedures.
4. Locations:
   a. Exposed sawcuts and non-moving control joints in concrete slabs subject to heavy loads.

2.05 ACCESSORIES

A. Sealant Backing, General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
1. Sealant Backing Manufacturers:
   a. Adfast.
   b. Alcot Plastics.
   c. Nomaco.

d. W.R. Meadows.
e. Substitutions: See Section 01 2500 - Substitution Procedures

B. Sealant Backing Rod, Closed-Cell Type:
1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
2. Size: 25 to 50 percent larger in diameter than joint width.

C. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
1. Size: As recommended by manufacturer for Project conditions.
2. Thickness: 0.78 inch, with ridges along outside bottom edges for bonding area.
3. Color: As selected by Architect.
4. Products:
a. Tremco Commercial Sealants & Waterproofing; Spectrem Simple Seal: www.tremcosealants.com/#sle.
b. Substitutions: See Section 01 2500 - Substitution Procedures.

D. Preformed Extruded Polyurethane Joint Seal: Medium-modulus, preformed polyurethane extrusion used to bridge joints under elastomeric wall coatings, in sizes to fit applications indicated on drawings, combined with polyurethane sealant for bonding joint seal to substrates.
1. Size: As recommended by manufacturer for Project conditions.
2. Thickness: 0.051 inch, with ridges along outside bottom edges for bonding area.
3. Color: As selected by Architect.
4. Products:
a. Dayton Superior.
b. Emseal (Sika).
c. Tremco.
d. Willseal.
e. Substitutions: See Section 01 2500 - Substitution Procedures.

E. Backing (Bond-Breaker) Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
1. Manufacturers:
a. 3M.
b. Berry Plastics Corporation.
c. C.R. Laurence.
d. Scapa Tapes North America.
e. Valley Industrial Products.

F. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

G. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

H. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Do not exceed pot life of material as documented in writing by manufacturer.

C. Provide joint sealant installations complying with ASTM C1193.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Owner to engage a qualified testing agency to perform tests and inspections.
   1. Joint sealants will be considered defective if they do not pass tests and inspections.
   2. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   3. Testing and inspecting agency to prepare reports and deliver to Owner or Contractor.
   4. Submit field quality control reports to Architect.

C. Tests:
   1. Field Adhesion Testing: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
      a. Perform 10 tests for the first 1,000 linear feet of joint, for each kind of sealant and joint substrate.
      b. Perform 1 test for each 1,000 linear feet of joint thereafter, or one test per each floor per elevation.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

1.02 PROTECTION

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.

B. Protect joint sealants during and after curing period from contact with contaminating substances or damage from subsequent construction activities.

END OF SECTION 079200

SECTION 099600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

F. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

G. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2016.

H. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual Volume 2; 2021.

I. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024.

J. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

K. SSPC-SP 2 - Hand Tool Cleaning; 2018.

L. SSPC-SP 3 - Power Tool Cleaning; 2018.

M. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

N. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal; 2020.

O. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Sustainable Product Data: See Section 01 6000 - Product Requirements and Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
   1. VOC content restrictions data.

2. CAL (CDPH SM) compliance data.

D. Manufacturer's Certificate: Certify that high-performance coatings comply with VOC limits specified.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include cleaning procedures and repair and patching techniques.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Coating Materials: 1 gallon of each type and color.
   2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.04 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum tenyears documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

E. See Section 01 7419 - Construction Waste Management and Disposal, for packaging waste requirements.

1.06 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Restrict traffic from area where coating is being applied or is curing.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a one (1) year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 SUSTAINABLE PRODUCT REQUIREMENTS

A. See Section 01 6000 - Product Requirements.

B. VOC Content Restrictions: Products in this section to not exceed VOC content limits specified in Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. CDPH: Products to comply with CAL (CDPH SM) .

2.02 MANUFACTURERS

A. High-Performance Coatings:
   1. Dow.
   2. Dunn Edwards.
   3. ICI.
   4. Kelly-Moore.
   5. PPG.
   6. Precision Coatings.
   7. Rust-Oleum
   8. Sika.
   9. Sherwin-Williams.
   10. Tnemec.
   11. Substitutions: See Section 01 2500 - Substitution Procedures.

2.03 HIGH-PERFORMANCE COATINGS

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in MPI Approved Products List.

2.04 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
   1. Colors: As shown on the Architectural drawings, or as otherwise selected from manufacturer's full range.

B. Elastomeric Coating:
   1. Number of Coats: Two.
   2. Top Coat(s): Exterior Pigmented Elastomeric, Water Based; MPI #113.
      a. Sheen: Flat.
      b. Products:
         1) Dow; DOWSIL ALLGUARD Silicone Elastomeric Coating: www.dow.com/#sle.
         2) Pittsburg Paints; Perma-Crete Pitt-Flex Elastomeric Coating, 4-110XI Series, Flat: www.ppgpaints.com/#sle. (MPI #113)
         3) Tnemec Company, Inc; Series 156 Enviro-Crete: www.tnemec.com/#sle.
         4) Substitutions: See Section 01 2500 - Substitution Procedures.

C. Urethane Coating for Steel:
   1. Number of Coats: Two.
   2. Product Characteristics:

a. Dry film thickness, per coat: 2-3 mils, minimum.

3. Top Coat(s): Polyurethane, Two-Component; MPI #72, #174.
   a. Sheen: Semi-Gloss.
   b. Products:
      1) Stonhard; Stonglaze VSE: www.stonhard.com/#sle.
      2) Tnemec Company, Inc; Series 1095 Endura-Shield: www.tnemec.com/#sle.
      3) Substitutions: See Section 01 2500 - Substitution Procedures.
4. Top Coat(s): Polyurethane, Water Based, Two-Component.
   a. Sheen: Satin.
   b. Products:
      1) PPG Paints; Amerishield VOC Polyester Acrylic Polyurethane, AMV-3 Series, Gloss: www.ppgpaints.com/#sle.
      2) Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane, Low Sheen: www.protective.sherwin-williams.com/#sle.
      3) Tnemec Company, Inc; Series 297 Enviro-Glaze: www.tnemec.com/#sle.
      4) Substitutions: See Section 01 2500 - Substitution Procedures.

D. Graffiti-Resistant Coating:
   1. Number of Coats: As recommended by manufacturer.
   2. Top Coat: Polysiloxane hybrid coating.
      a. Color: Clear.
      b. Sheen: Satin.
      c. Products:
         1) RainguardPro; Micro-Seal with Graffiti Control Water Repellent / Anti-Graffiti: www.rainguardpro.com/#sle.
         2) Sherwin-Williams; Anti-Graffiti Coating.
         3) Tex-Cote LLC; Graffiti Gard IV Clear.
         4) Substitutions: See Section 01 2500 - Substitution Procedures.

E. Fluoropolymer Coating:
   1. Top Coat(s): Air Dry Fluoropolymer, One or Two Component.
      a. Sheen: Gloss.
      b. Finish: Metallic.
      c. Products:
         1) APV Engineered Coatings; NeverFade Original Restoration Topcoat: www.apvcoatings.com/#sle.
         2) Arkema, Inc; Kynar Aquatec: www.arkema.com/#sle.
         3) Pittsburg Paints; Coraflon ADS: www.ppgpaints.com/#sle.
         4) Tex-Cote LLC; Reflect-TEC Heat Reflective Roof & Wall Coating: www.texcote.com/#sle.
         5) Tnemec Company, Inc; Series 1071V Fluoronar: www.tnemec.com/#sle.
         6) Substitutions: See Section 01 2500 - Substitution Procedures.

F. Primers: As recommended by coating manufacturer for specific substrate, unless otherwise specified.

G. Shellac: Pure, white type.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
   2. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   4. Concrete Floors and Traffic Surfaces: 8 percent.
   5. Wood: Do not begin application if substrate has moisture content over 12 percent.

F. Proceed with coating application only after unacceptable conditions have been corrected.
   1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

B. Clean surfaces of loose foreign matter.

C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

D. Remove finish hardware, fixture covers, and accessories and store.

E. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Prepare surface as recommended by coating manufacturer and in accordance with SSPC-SP 13/NACE No.6.

F. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by coating manufacturer.

G. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3,

and protect from corrosion until coated.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete: Prior to priming, patch with masonry filler to produce smooth surface.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION 099600

SECTION 116833
ATHLETIC FIELD EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Football field equipment.

B. Soccer field equipment.

C. Track and field equipment.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Footings for field equipment.

B. Section 099113 - Exterior Painting.

C. Section 312200 - Grading: Shaping subgrade to specified grade levels.

1.03 ABBREVIATIONS

A. FIFA - Federation Internationale de Football Association; www.fifa.com.

B. NCAA - National Collegiate Athletic Association; www.ncaa.org.

C. NFHS - National Federation of State High School Associations; www.nfhs.com and www.nfhs.org.

D. U.S. CPSC - United States Consumer Product Safety Commission; www.cpsc.gov.

E. USFHA - United States Field Hockey Association; www.teamusa.org/USA-Field-Hockey.

1.04 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

D. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing; 2020a.

E. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

F. ASTM B108/B108M - Standard Specification for Aluminum-Alloy Permanent Mold Castings; 2019.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

J. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test; 2022.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Convene a meeting one week before starting this work to discuss coordination between various installers.
   1. Require attendance by personnel responsible for grading and installers of athletic field equipment, footings, and adjacent work.
   2. Include representatives of Contractor.
   3. Notify Architect at least two weeks prior to meeting.

1.06 SUBMITTALS

A. Product Data: Provide athletic field equipment manufacturer's product data indicating materials of construction, compliance with specified standards, installation procedures, and necessary safety limitations.

B. Shop Drawings: Submit detailed scale drawings showing athletic field equipment and perimeter layout.
   1. Indicate locations and dimensions of footings and anchorage points.
   2. Identify mounting elevations in relation to fixed survey point on site, and subgrade elevation.
   3. Indicate location of underground utilities, storm drainage system, and irrigation system.

C. Maintenance Data: Submit manufacturer's recommended maintenance instructions and list of replaceable parts for each athletic field equipment item, along with supplier's address and phone number.

D. Installer's Qualification Statement.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store equipment on project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, and elevated above grade.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum 10 year manufacturer warranty for athletic field equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Athletic Field Equipment:
   1. Sportsfield Specialties, (888) 975-3343
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 ATHLETIC FIELD EQUIPMENT - GENERAL

A. High School Sports: Provide equipment that complies with NFHS requirements.

B. Mount supporting posts in concrete footings, unless otherwise indicated, refer to Section 033000 for additional concrete footing installation requirements.

C. Coordinate field grading as required for proper placement and arrangement of equipment, refer to Section 312200 for additional information.

D. Safety and Warning Signage: Provide signage as indicated on drawings and required by authorities having jurisdiction.

2.03 FOOTBALL FIELD EQUIPMENT

A. High School Goal Post: Football goal post with single support post, crossbar and two uprights.
   1. Crossbar that supports uprights on each end, 6" Sch. 40 galvanized steel with powder coating; mount with 10 feet of clearance above grade.
   2. Support post, 6" Sch. 40 galvanized steel with powder coating.
      a. Provide 8 feet curved offset gooseneck type support post and connected with crossbar.
   3. Powder Coat Color: Yellow.

B. Football Goal Post Padding: Wrap-around pad for goal supporting post, using hook and loop fastener straps for attachment around post.
   1. Round Post: 6-5/8 inch outside diameter.
   2. Pad Height: 6 feet.
   3. Padding Material: High density urethane foam, at least 5.5 inch thick with 18 ounce mildew resistant and ultraviolet (UV) resistant coated vinyl.
   4. Color: Light Blue

2.04 SOCCER FIELD EQUIPMENT

A. Portable Soccer Goal: Uprights and cross bar, white colored, and constructed of 4 inch square extruded aluminum tubing, with 3inch by 2inch backstays and rear stabilizing bar constructed of 2 inch square galvanized steel tubing with plated connection hardware.
   1. Size: 8 feet high by 24 feet wide by 8 feet deep in accordance with NCAA, NFHS, and FIFA requirements.
   2. Provide soccer goal safety system for anchor.
   3. Soccer Nets: Polypropylene material with 23 lbs weight and white colored of size to fit soccer goal indicated.
   4. Wheel Assembly: Provide non-flat type removable swivel wheels, four total, that allow for easy mobility of goal.

2.05 TRACK AND FIELD EQUIPMENT

A. Products
   1. See drawing L0.01 sports equipment legend for model numbers, quantity, finish, color, and materials.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that athletic field equipment area has been graded to subgrade elevations required and that excess soil, rocks, and debris has been removed as necessary for installation of footings.

3.02 PREPARATION

A. Stake location of athletic field equipment elements, including necessary athletic field perimeters, surfacing, access and egress points, hard surfaces, walls, fences, and/or structures.

B. Stake layout of athletic field equipment perimeter in accordance with approved shop drawings before starting any work.
   1. Verify that athletic field perimeters do not overlap hard surfaces, whether currently installed or not.
   2. Verify that athletic fields are free of obstructions.
   3. If conflicts or obstructions are found, notify Architect.
   4. Do not proceed with this work until revised drawings have been provided, showing corrected layout, and that any obstructions have been removed or corrections to layout have been made.

3.03 INSTALLATION

A. Install athletic field equipment in accordance with manufacturer's instructions, and rules and regulations of specified athletic association indicated for this work.

B. Install athletic field equipment without sharp points, edges, or protrusions; entanglement hazards or pinch, crush, or shear points.

C. Install safety and warning signage in accordance with indicated requirements.

3.04 CLEANING

A. Clean athletic field equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

B. Clean athletic field area of excess construction materials, debris, and waste.

C. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION 116833

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Intermediate metal conduit (IMC).
D. PVC-coated galvanized steel rigid metal conduit (RMC).
E. Flexible metal conduit (FMC).
F. Liquidtight flexible metal conduit (LFMC).
G. Electrical metallic tubing (EMT).
H. Rigid polyvinyl chloride (PVC) conduit.
I. Electrical nonmetallic tubing (ENT).
J. Liquidtight flexible nonmetallic conduit (LFNC).
K. Reinforced thermosetting resin conduit (RTRC).
L. Conduit fittings.
M. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 078400 - Firestopping.
C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
D. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
E. Section 260529 - Hangers and Supports for Electrical Systems.
F. Section 260533.16 - Boxes for Electrical Systems.
G. Section 260533.23 - Surface Raceways for Electrical Systems.
H. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
I. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
J. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
K. Section 271000 - Structured Cabling: Additional requirements for communications systems conduits.
L. Section 312316 - Excavation.
M. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.
N. Section 312323 - Fill: Bedding and backfilling.
O. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.

D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014 (Reaffirmed 2019).

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

P. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

Q. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

S. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

T. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.

6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:
1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT). Do not use MC cable in walls or ceilings except for the final connection to lighting fixtures, and less than 6' lengths.

F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
1. Locations subject to physical damage include, but are not limited to:
a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Electrical Service Conduits: Also comply with Section 262100.

C. Communications Systems Conduits: Also comply with Section 271000.

D. Fittings for Grounding and Bonding: Also comply with Section 260526.

E. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
   2. Underground, Interior: 3/4 inch (21 mm) trade size.
   3. Underground, Exterior: 1 inch (27 mm) trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
   4. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.

4. Material: Use aluminum.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Thomas & Betts Corporation www.tnb.com/#sle.
2. Robroy Industries www.robroy.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. Interior Coating: Urethane, minimum thickness of 2 mil.

E. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.07 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
2. Electri-Flex Company www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.09 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit www.alliedeg.com/#sle.
   2. Republic Conduit www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

4. Connectors and Couplings: Use compression (gland) or set-screw type.
   a. Do not use indenter type connectors and couplings.
   b. Do not use set-screw type connectors and couplings.
5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com/#sle.
   2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
   3. JM Eagle www.jmeagle.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

B. Supports: Per manufacturer's recommendations.

C. Fittings: Same type and manufacturer as conduit to be connected.

2.12 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

E. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

G. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

H. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

I. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and

holes for stabilization cable; suitable for the casing and conduit/duct arrangement to be installed.

1. Products:
   a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive conduits.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
H. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet between pull points.
   10. Route conduits above water and drain piping where possible.
   11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.

13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in the same area together on a common rack.

I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of spring steel conduit clips for support of conduits is not permitted.
11. Use of wire for support of conduits is not permitted.
    a. For securing conduits to studs in hollow stud walls.
    b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).
12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

K. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

L. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 312316.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 260553 along entire conduit length for service entrance where not concrete-encased.

M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
3. Install conduits within middle one third of slab thickness.
4. Secure conduits to prevent floating or movement during pouring of concrete.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 033000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
4. Where conduits are subject to earth movement by settlement or frost.

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

2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

S. Provide grounding and bonding in accordance with Section 260526.

T. Identify conduits in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 260533.13

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Boxes for hazardous (classified) locations.

E. Floor boxes.

F. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 078400 - Firestopping.

C. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

D. Section 260526 - Grounding and Bonding for Electrical Systems.

E. Section 260529 - Hangers and Supports for Electrical Systems.

F. Section 260533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

G. Section 260533.23 - Surface Raceways for Electrical Systems:
   1. Accessory boxes designed specifically for surface raceway systems.
   2. Lay-in wireways and wiring troughs with removable covers.

H. Section 260539 - Underfloor Raceways for Electrical Systems: Junction boxes for underfloor duct systems.

I. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

J. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

K. Section 262726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Poke-through assemblies.
   4. Access floor boxes.
   5. Additional requirements for locating boxes for wiring devices.

L. Section 262813 - Fuses: Spare fuse cabinets.

M. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

N. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes: Concrete manholes for electrical systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Samples:
1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
6. Use suitable concrete type boxes where flush-mounted in concrete.
7. Use suitable masonry type boxes where flush-mounted in masonry walls.

8. Use raised covers suitable for the type of wall construction and device configuration where required.
9. Use shallow boxes where required by the type of wall construction.
10. Do not use "through-wall" boxes designed for access from both sides of wall.
11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
16. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Communications Systems Outlets: Comply with Section 271000.
17. Wall Plates: Comply with Section 262726.
18. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    e. Thomas & Betts Corporation: www.tnb.com/#sle.
    f. Substitutions: See Section 016000 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
    c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
1. Manufacturers:

a. Hubbell Incorporated: www.hubbell.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.

E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
1. Manufacturers:
a. Appleton, a brand of Emerson Electric Co: www.emerson.com/#sle.
b. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
c. Hubbell Incorporated; Killark Products: www.hubbell-killark.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

F. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Use sheet-steel or cast iron floor boxes within slab above grade.
4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.

G. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
a. Manufacturers:
1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com/#sle.
2) MacLean Highline: www.macleanhighline.com/#sle.
3) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.
b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
c. Product(s):
1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
(a) 11 by 18 by 12 inches nominal; Model PHA111812 (stackable).
2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
(a) 11 by 18 by 12 inches nominal; Model CHA111812.
3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.
(a) 30 by 48 by 18 inches nominal; Model CVA304818.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

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

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
   b. Communications Systems Outlets: Comply with Section 271000.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.

11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required seismic controls in accordance with Section 260548.
3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.

M. Install boxes as required to preserve insulation integrity.

N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

P. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Section 033000, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

S. Close unused box openings.

T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

U. Provide grounding and bonding in accordance with Section 260526.

V. Identify boxes in accordance with Section 260553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 260533.16

SECTION 311000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and grubbing of the site, including the removal of debris, vegetation, foreign objects, concrete slabs and foundations, asphalt paving, portland concrete paving and curbs, site lighting and bases, site walls, area drains and catch basins, unwanted existing underground utilities and drain lines, conduits, trees, and other site construction as indicated and as required for grading the site suitable for constructing the proposed project.

1.02 RELATED REQUIREMENTS

PART 2 PRODUCTS

2.01 MATERIALS

A. Sedimentation Barrier: See Section 015713 - Temporary Erosion and Sediment Control.

B. Fill Material: As indicated in the Project Geotechnical Report and approved by the Geotechnical Engineer.

PART 3 EXECUTION

3.01 PREPARATION

A. Erect barriers, fences, guard rails, enclosures, and shoring to protect personnel, structures, the public, and site improvements and utilities to be maintained intact.

B. Protect and maintain benchmarks and survey control points from disturbance during construction.

C. Locate and clearly flag trees and vegetation to remain or be relocated.

D. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.02 SITE CLEARING

A. Comply with additional requirements specified in Section 017000 - Execution and Closeout Requirements.

B. Fill depressions caused by clearing and grubbing operations with material satisfactory to the geotechnical engineer unless further excavation or earthwork is indicated.

C. Place fill material in horizontal layers in accordance with the recommendations in the project geotechnical report and compact each layer to a density satisfactory to the geotechnical engineer.

3.03 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths is encountered in a manner to prevent intermingling with underlying subsoil or other waste.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.04 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with local requirements; obtain required permits.

B. Protect existing utilities, utility structures, and associated appurtenances to remain from damage.

C. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's Representative written permission.

D. Do not disrupt public utilities without permit from authority having jurisdiction.

E. Protect existing structures and other elements that are not to be removed. Remove unwanted existing utilities as indicated or as uncovered by work, and cap in a manner conforming to Code. Determine status of utility lines encountered that are not shown on the Contract Drawings. If abandoned, remove and dispose of in proper manner.

F. Install sedimentation barrier according to Section 015713 - Temporary Erosion and Sediment Control.

G. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Check with local jurisdiction for any needed inspection permits.

3.05 CLEARING AND GRUBBING

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, trash enclosure area, paving, lawns, and planting beds.

B. Clear site after relocating vegetation in accordance with ANSI A300 Part 6.

C. Preservation of existing vegetation: The construction schedule shall consider the amount and duration of soil exposed to erosion by wind, rainfall, and vehicle tracking and seek to minimize disturbed soil during the rainy season. A schedule shall be prepared that shows the sequencing of construction activities with installation of maintenance of soil stabilization and sediment control BMPs.

D. Do not remove or damage vegetation beyond limits indicated on drawings.

E. Install substantial, highly visible fences at least 6 feet high to prevent inadvertent damage to vegetation to remain:
   1. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
   2. Around other vegetation to remain within vegetation removal limits.
   3. See Section 015000 for fence construction requirements.

F. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum subsoil disturbance.

3.06 REMOVED VEGETATION PROCESSING

A. Do not burn, bury, landfill, or leave on-site, except as indicated on drawings.

3.07 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements as indicated and as necessary to facilitate new construction.

B. Demolish and completely remove existing construction as indicated from the site, including subsurface conditions designated to be removed or required to be removed to facilitate the work of the proposed project.
   1. Demolish asphalt, concrete, and masonry in small sections. Continuously wet down debris to prevent creation of dust or fire hazard.
   2. Fragments: Remove from the site asphalt and concrete fragments exceeding 6 inches in maximum dimension.

3.08 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and windblown debris from public and private lands.

END OF SECTION 311000

SECTION 312200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough grading.

1.02 RELATED REQUIREMENTS

A. Section 311000 - Site Clearing.

B. Project Geotechnical Report.

C. Standard Specifications for Public Works Construction (Greenbook); current edition.

1.03 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Standards Specifications for Public Works Construction (Greenbook); current edition.

B. Perform work in accordance with Project Geotechnical Report.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gravel: Excavated on-site.

1. Graded according to ASTM D2487 Group Symbol GW, GP, or SP.

B. Fill Material: As indicated in the Project Geotechnical Report and approved by the Geotechnical Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify survey bench mark and intended elevations for grading areas are as indicated.

B. Verify the absence of standing or ponding water.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect above- and below-grade utilities to remain.

D. Provide temporary means and methods to remove standing or ponding water from areas prior to grading.

E. Protect site features to remain, including but not limited to bench marks, survey control points, and fences.

3.03 ROUGH GRADING

A. Excavate and fill subgrade material to elevations indicated on plans.

B. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
   1. Remove sod, grass, and any other vegetation before stripping top soil.
   2. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
   3. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other waste materials.
   4. Strip topsoil to depth indicated on drawings.

C. Horizontally bench existing slopes greater than 1:4.

D. Replace displaced subgrade in accordance with Section 312323.

E. Remove and replace unsuitable materials as specified fill.

3.04 FINE GRADING

A. Scrape and spread subgrade material uniformly smooth and without disruptions as indicated on drawings.

3.05 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.
   1. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water and other erosion control measures.
      a. Limit height of topsoil stockpiles to 72 inches.
      b. Do not stockpile topsoil within plant protection zones.
      c. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or resued.

B. Stockpile subsoil to be re-used on site; remove remainder from site.

3.06 TOLERANCES

A. Top Surface: Plus or minus 1/2 inch.

3.07 FIELD QUALITY CONTROL

A. Compaction density testing shall be as described in the Project Geotechnical Report and as approved by the Geotechnical Engineer.

3.08 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove unused stockpiled subsoil. Grade stockpile area to prevent standing water.

C. Leave site clean and raked, ready to receive work.

END OF SECTION 312200

SECTION 320190
LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, material, equipment and services required to maintain landscape in a healthy growing condition and in a neat and attractive appearance throughout the maintenance period.

1.02 RELATED REQUIREMENTS

A. Division 32 Section Landscape Irrigation

B. Division 32 Section Landscape Work

1.03 QUALITY ASSURANCE

A. The Maintenance Contractor shall be experienced in horticulture and landscape maintenance, practices and techniques, and shall provide sufficient number of workers with adequate equipment to perform the work during the maintenance period.

1.04 MAINTENANCE PERIOD

A. Continuously maintain the entire project area during the progress of the work and during the ninety (90) calendar-day maintenance period until final acceptance of the project by the Landscape Architect,

1. Maintenance Period begins after all punchlist and corrective items have been accepted by the Landscape Architect and owner.

B. Maintenance period shall not start until all punch list items are addressed, when all elements of construction, planting and irrigation for the entire project are in accordance with Plans and Specifications. A prime requirement is that all lawn and landscape areas shall be planted and that all lawn areas shall show an even, healthy stand of grass seedlings which shall have been mown twice. If such criteria are met to the satisfaction of the Landscape Architect, a written notification shall be issued to establish the effective beginning date of maintenance period.

C. Any day of improper maintenance, as determined by the Landscape Architect, shall not be credited as an acceptable maintenance period day. The maintenance period shall be extended on a daily basis if the work is not in accordance to the Plans and Specifications. Project shall not be segmented into maintenance areas or phases, unless authorization of the Landscape Architect is obtained.

D. Maintenance shall continue beyond the ninety (90) day maintenance period, as required, until final acceptance is given by the Landscape Architect.

E. Contractor shall provide protection to the project site during the maintenance period.

F. A phased maintenance period will not be accepted.

1.05 GUARANTEE AND REPLACEMENT

A. Guarantee: All plant material and other materials installed under the Contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship or improper maintenance, as determined by the Landscape Architect, and shall be replaced by the Contractor at

his expense. Warranty periods are as follows:

1. Trees, vines, and shrubs: One Year
2. Groundcover and Turf: One year.

B. Replacement: Any materials found to be dead, missing, declining or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The Landscape Architect shall be sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within five (5) days of written notification by the Landscape Architect or owner. All replacement materials and installations shall comply with the Plans and Specifications. Any plant missing due to suspected theft shall be replaced by the Contractor. If the Contractor suspects that theft may be a problem, the Contractor shall provide written documentation to the owner that security on this site needs to be intensified.

C. The Contractor may relieve himself of theft responsibility if after the security notice, with no result, a written notice to the owner shall be given that plant material will not be replaced for theft or vandalism due to lack of site security being maintained. This procedure may take place only during the Landscape Maintenance Period.

1.06 OBSERVATION SCHEDULE

A. Normal progress observations shall be requested by the Contractor from the Landscape Architect as per observations listed in specifications Division 32 Section "Landscape Work."

1.07 FINAL ACCEPTANCE OF THE PROJECT

A. Upon completion of all project work, including maintenance period, the Landscape Architect will, upon proper written request, make an observation to determine final project acceptability. Provide minimum a 14 business day notice for final observation.

B. Where observed work does not comply with the Plans and Specifications, replace rejected work and continue specified maintenance period until reinspected by the Landscape Architect and determined to be acceptable. All replacement materials and installations shall be in accordance with the Plans and Specifications. Remove rejected work and materials immediately from project. Prior to the date of final observation, Contractor shall provide the Landscape Architect with all Record Drawings and close out documents in accordance with the Plans and Specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials used shall either conform to Specifications in other sections or shall otherwise be acceptable to the Landscape Architect. The Landscape Architect shall be given a monthly record of all herbicides, insecticides and disease control chemicals used and irrigation scheduled. <u>The amendments listed herein are for Bidding purposes only. The final amendment types and rates shall be determined by the Agronomic Soils Test.</u>

B. Turf maintenance fertilizer: shall be "Best Turf Supreme 16-6-8":

1. 16% nitrogen
2. 6% phosphoric acid
3. 8% potash

C. Slow Release maintenance fertilizer: shall be "Best Superturf 25-5-5 with Polyon" and shall consist of the following percents by weight:

1. 25% nitrogen
2. 5% phosphoric acid
3. 5% potash

PART 3 - EXECUTION

3.01 GENERAL MAINTENANCE

A. General: Proper maintenance, including watering, weeding, mowing, edging, fertilization, rolling of turf, replacement and infill of mulch replacement of jute mesh, infill of settled areas, repairing and protection shall be required until entire project is finally accepted, but in any event for a period of not less than the specified maintenance period after planting.

B. Watering: Thoroughly water to insure vigorous and healthy growth until work is accepted. Water in a manner to prevent erosion due to application of excessive quantities of water. When hand watering use a water wand to break the water force. Supplemental hand water as required to maintain and encourage the proper growth of new and existing plant material.

C. Weeding:
   1. Keep plant basins, turf areas and areas between plants free of weeds. Control weeds with hand removal. Avoid frequent soil cultivation that destroys shallow roots. Weeding also shall be included in all paved areas including public or private sidewalks.
   2. Hand weed, to maintain all areas free of weeds including turf species other than the specified species. Periodic or predetermined weeding schedules may not be adequate and should be supplemented.
   3. In compliance with VUSD Green Standards, apply a final application of pre-emergent herbicide at the end of the maintenance period, just prior to final acceptance.

D. Tree basins in turf areas: Remove turf from around each tree to create a 4'- 0" diameter basin depending on tree size.

E. Pruning
   1. Trees: Prune trees to select and develop permanent scaffold branches; to eliminate narrow V-shaped branch forks that lack strength; to reduce toppling and wind damage by thinning out crowns; to maintain a natural appearance and to balance crown with roots. All trees shall be maintained and pruned in accordance with the accepted practices of the American Society of Consulting Arborists (ASCA). Prune only as directed by the Registered Consulting Arborists and Landscape Architect.
   2. Shrubs: Same objectives as for trees. Shrubs shall not be clipped into balled or boxed forms unless such is required by the landscape plans. All pruning cuts shall be made to lateral branches, buds or flush with the trunk. Stubbing and heading shall not be permitted.
   3. Only skilled workers shall perform pruning work in accordance with standard horticultural pruning practices. Remove from the project all pruned branches and material. Remove and replace any plant material excessively pruned or malformed resulting from improper pruning practices at no additional costs to the owner.
   4. Improperly pruned plant material as determined by the Landscape Architect is to be replaced at no cost to the owner.

F. Staking and Guys: Stakes and guys shall remain in place through the guarantee period and shall be inspected and adjusted to prevent rubbing that causes bark wounds. Remove nursery stake from all trees that are staked with lodgepole stakes per specifications. Provide supplemental staking or guying as required during high wind events to prevent damage to trees. Any damaged tree caused by high winds must be replaced by the contractor at no cost to the owner.

G. Insect, Animal, Rodent and Disease Control: Maintain proper control with legally approved materials as required as part of the Contract.

H. Protection: The Contractor shall maintain protection of the planted areas. Damaged areas shall be repaired or replaced at the Contractor's expense.

I. Trash: Remove trash weekly in all planted areas, pedestrian walkways and parking areas. Maintain all areas free of trash, clippings, and debris at all times.

J. Replacement: As per Guarantee and Replacement Specifications of this Section.

K. Fertilization: Fertilize all planting areas, during and just prior to end of maintenance period with the slow release maintenance fertilizer as indicated in the agronomic soils report.

L. Watering: Planting areas shall be watered at such frequency as weather conditions require to replenish soil moisture below root zone and to establish healthy plant material.
   1. Contractor is responsible for water audits and payment of any local penalties by local water districts at no additional cost to the Owner.

3.02 LAWN AND TURF MAINTENANCE

A. Mowing and Edging
   1. Initial mowing of turf will commence when the grass has reached a height of two and one-half (2-1/2) inches. The height of cut will be two (2) inches. After initial establishment maintain Bermuda and creeping grasses at 1½" and fescues or rye grass at 2". Mowing will be at least every 4-6 days for the second through fifth cuttings, and at least once per week after that for fescue. Bermuda grass is to be mowed minimum twice a week. Bent grass is to be mowed daily. Turf must be well established and free of bare spots and weeds to the satisfaction of the Landscape Architect prior to final acceptance.
   2. Excess grass clippings shall be picked up and removed from the site and premises. Let turf areas dry out enough so that mower wheels do not skid, tear or mark the lawn. Edges shall be trimmed at 90 degrees to pavement, at least weekly or as needed for neat appearance. Clippings shall be removed from paved and planting areas, etc. and disposed of from the site.

B. Watering: Lawns shall be watered at such frequency as weather conditions require to replenish soil moisture below root zone and to establish healthy strands of grass.
   1. Contractor is responsible for water audits and payment of any local penalties by local water districts at no additional cost to the Owner.

C. Disease control: Control turf diseases throughout the maintenance period, in compliance with VUSD Green Standards, with legally approved fungicides and herbicides. Replace any damaged or infected grass.

D. Fertilization:
   1. During maintenance period an application of turf maintenance fertilizer, as specified, shall be made at thirty (30) day intervals from the date of maintenance period start at a rate of five (5) pounds per 1,000 square feet, and as required by the agronomic soils report.
   2. Final application (just prior to final acceptance) shall be made with the slow-release maintenance fertilizer as required by the agronomic soils report.
   3. Replacement: At conclusion of maintenance period a final observation of lawn and turf areas shall be made. Remove diseased areas and unhealthy strands of grass from the site; do not bury into the soil. Replant areas with material and in a manner as specified on the Plans and Specifications at no additional cost to the Owner. All grass is to be fully grown with 100% coverage with a suitable thatch layer prior to turnover and final acceptance.

E. Arborist: Provide a written report and recommendations as required by the landscape architect if any plant material is in the sole opinion of the landscape architect, declining, stressed, infested, or otherwise not growing at the anticipated growth rate. The report is to include Agronomic Soils Test Data and recommendations and be provided at no cost to the owner.

3.03 IRRIGATION SYSTEM

A. System Observation: The Contractor shall check all systems for proper operation. Lateral lines shall be flushed out after removing the last sprinkler head or two at each end of the lateral. All heads are

to be adjusted as necessary for unimpeded head to head coverage.

B. Valves: Contractor shall set, and verify that all pressure regulating valves to the operating pressure specified on the drawings.

C. Controllers: Set and program automatic controllers for seasonal water requirements. Give the Owner's Representative instructions on how to turn off system in case of emergency.

D. If the irrigation system is designed and specified to be operable from a central irrigation computer controller located off site, or a standard controller on site. The contractor shall demonstrate to Landscape Architect, Owner's Representative and future maintenance contractor that the central irrigation system is fully installed and operational from this off site control system as described and specified. Contractor shall make all adjustments as necessary to insure this operation prior to final acceptance.

E. Contractor shall set up and coordinate training for the Maintenance Contractor (Provider) on the irrigation controller, and pump with the manufactures representative. Maintenance period shall not end, and the project will not be accepted until this training has been completed.

F. Repairs: Repair all damages to irrigation system at the Contractor's expense. Repairs shall be made within twenty-four (24) hours or sooner to prevent damage to site improvements.

3.04 CLEANING

A. During maintenance work, keep pavements clean and work area in an orderly condition. Haul away and remove all debris from landscape areas, and do not leave any clippings, fertilizer, amendments and / or other material from landscape planting and/or maintenance period.

B. Powerwash all pavement and flatwork as necessary to remove all staining and tire marks on surfaces caused by maintenance or construction vehicles, prior to final acceptance.

END OF SECTION 320190

SECTION 321123
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

1.02 RELATED REQUIREMENTS

A. Section 312200 - Grading: Preparation of site for base course.

B. Section 321216 - Asphalt Paving: Finish and binder asphalt courses.

C. Section 321313 - Concrete Paving: Finish concrete surface course.

D. Project Geotechnical Report.

1.03 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil–Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).

B. 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 .

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2019.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

E. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).

F. 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).

G. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.

H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017, with Editorial Revision (2020).

I. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2023.

J. Standard Specifications for Public Works Construction (Greenbook); current edition.

K. California State Department of Transportation Standard Specifications (Caltrans); current edition.

L. Project Geotechnical Report.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Materials Sources: Submit name of imported materials source, location, and gradation of the material.

C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Aggregate Storage, General:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate Base: Crushed aggregate base, conforming to Greenbook, Section 200-2.2.

B. Herbicide: VUSD Green Standards.

2.02 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general requirements for testing and analysis of aggregate materials.

B. Where aggregate materials are specified using ASTM D2487 classification, testing of samples for compliance will be provided before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

A. Spread aggregate over prepared substrate to a total compacted thickness as indicated on plans.

B. Place aggregate in maximum 4 inch layers and roller compact to specified density.

C. Level and contour surfaces to elevations and gradients indicated.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

G. Permeable Aggregate Base for Synthetic Turf
   1. Contractor shall apply water to the aggregate on site to attain and maintain 90% to 100% of the optimum moisture content.
   2. Prior to placement, remove any excess of contaminated backfill from any existing drainage trenches.
   3. Should any separation of the materials occur during any stage of the spreading or stockpiling, the Contractor must immediately remove and dispose of segregated material and correct or change handling procedures to prevent further separation. Double handling of materials should be avoided.
   4. Contractor shall utilize laser-controlled equipment for the garding of the permeable aggregate to ensure accuracy in grading tolerances.
   5. Each layer must be spread uniformly with equpment that will not cause perceptible separation in gradation (segregation of the Permeable aggregate base), preferably a self-propelled paving machine, or a small grader or low ground pressure (LPG) dozer.
   6. Contractor shall grade the surface of the processed staone acceptable to receive the final synthetic turf surface system.
   7. The permeable aggregate base shall be compacted to a minimum compaction of 90% and maximum compaction of 93%. (ASTM D698)
   8. The area should be compacted at 2 inch increments to ensure uniform compaction throughout the entire area.
   9. Permeable Aggregate Base Testing
      a. Test samples shall be taken (at minimum of) one sample per every 10,000 square feet or as otherwise directed by the Owner's Representative. Final in-place aggregate shall have a percolation rate of note less than 20 inches per hour.
         1) ASTM F2898 (Overflow)
      b. If at any time the permeable base does not meet specifications, it shall be the Contractor's responsibility to rstore the processed stone based to the required grade and density.
      c. When the Contractor has independantly confirmed that the site is in compliance with all above listed requirements, he shall schedule a final inspection by the qualified FieldTurf installer. Any ideficiencies uncovered during this inspection must be remedied to the satisifaction of the installer before the base system will be considered acceptable.

3.04 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.06 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 321123

SECTION 321216
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single course bituminous concrete paving.

B. Double course bituminous concrete paving.

C. Surface sealer.

1.02 RELATED REQUIREMENTS

A. Section 312200 - Grading: Preparation of site for paving and base.

B. Section 321123 - Aggregate Base Courses: Aggregate base course.

C. Section 321313 - Concrete Paving: Concrete substrate.

D. Section 321313 - Concrete Paving: Concrete curbs.

E. Section 321723 - Pavement Markings

F. Project Geotechnical Report.

1.03 REFERENCE STANDARDS

A. AI MS-2 - Asphalt Mix Design Methods; 2015.

B. AI MS-19 - Basic Asphalt Emulsion Manual; 2008.

C. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

D. ASTM D3549 Standard Test Method for Thickness of Height of Compacted Asphalt Mixture Specimens (2018).

E. ASTM D2950 Standard Test Method of Density of Bituminous Concrete in Place by Nuclear Methods (2020).

F. Standard Specifications for Public Works Construction (SSPWC,Greenbook); current edition.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Standard Specifications for Public Works Construction (SSPWC) and the California Department of Transportation (Caltrans), latest editions and supplements for asphalt paving work.

B. Obtain materials from same source throughout.

1.05 **SUBMITTALS**

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1.06 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 50 degrees Fahrenheit and rising, or surface is wet or frozen.

B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Concrete: Greenbook, Section 203-6.

B. Aggregate Base Course: Section 321123.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Parking lots including drive aisles and parking spaces:
   1. Wearing course: III-C3 PG 64-10 per SPPWC Section 203-6.5.
   2. Base course: III-B3 PG 64-10 per SPPWC Section 203-6.5.

B. Playgrounds/Hardcourts/Playcourts.
   1. Wearing course: III-D PG 64-10 per SPPWC Section 203-6.5.
   2. Base course: III-B2 PG 64-10 per SPPWC Section 203-6.5.

C. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.03 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 AGGREGATE BASE COURSE

A. See Section 321123.

3.03 PREPARATION - TACK COAT

A. Apply tack coat in accordance with SPPWC (Greenbook), Section 302-5.4.

B. Apply tack coat to existing pavement including planed surfaces, between hot mix asphalt layers, and to vertical surfaces of curbs, gutters, construction joints and milled pavements.

3.04 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install work in accordance with SPPWC (Greenbook) 302-5.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Place to a maximum thickness per SSPWC 302-5.

D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Install work in accordance with SPPWC (Greenbook) 302-5.

B. Place asphalt base course within 24 hours of applying primer or tack coat.

C. No pavement course shall be less than 1 1/2 inches in compacted thickness. If finish pavement thickness is 3 inches or less it shall be laid as single course.

D. No pavement course shall be more than 4 inches in compacted thickness.

E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.06 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

3.07 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for quality control.

B. Provide final surfaces of uniform texture, conforming to required grades and cross sections.
   1. Test in-place asphalt concrete courses for compliance with requirement for density, thickness, and surface smoothness.
      a. Density:
         1) Field test density of compacted asphalt surface course shall be determined by a properly calibrated nuclear test gage in accordance with ASTM D2950.
      b. Thickness:
         1) Thickness of compacted paving shall conform to ASTM D3549 based on core test.
         2) In-place compacted thicknessess shall conform to the dimensions indicated on the contract drawings. Variation from indicated thicknesses shall not exceed plus-or-minus 1/4-inch.

C. Flood Testing
   1. Flood Test: Before acceptance, all pavements in the presence of the project inspector shall be water tested to ensure proper drainage. The contractor shall provide water for this purpose. The flooding shall be conducted with a water tank truck. Depressions where the water ponds to a depth of more than 1/8-inch shall be filled or the slope corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. No standing water shall remain 1-hour after test.

3.08 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.

END OF SECTION 321216

SECTION 321313
CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Curbs and gutters.
B. Walks.
C. Stairs and ramps.
D. Mow strips.
E. Wheel stops.

1.02 RELATED REQUIREMENTS

A. Division 03 Section Cast-in-Place Concrete
B. Division 05 Section Metal Fabrications
C. Division 05 Section Pipe and Tube Railings.
D. Division 05 Section Decorative Metal Railings
E. Division 31 Section Earthwork
F. Division 32 Section Architectural Site Concrete
G. Division 32 Section Concrete Paving Joint Sealants
H. Division 32 Section Chain Link Fences and Gates
I. Project Geotechnical Report and all subsequent revisions and supplemental addendums

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: Fly ash and other pozzolans, and ground granulated blast-furnace slag, subject to compliance with requirements.

1.04 PREINSTALLATION CONFERENCE

A. Conduct conference at Project site two weeks prior to start of work of this section. Required attendance of all affected installers.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
   2. Concrete mixture design
   3. Testing and inspection procedures.
   4. Concrete finishes and finishing.
   5. Cold- and hot-weather concreting procedures.
   6. Curing procedures.
   7. Construction joints.
   8. Forms and form-removal limitations.
   9. Reinforcement accessory installation.
   10. Concrete repair procedures.

11. Protection of cast-in-place architectural site concrete.
12. Review special testing and inspection procedures.
13. Placement sequence and schedule.
14. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
    a. Contractor's superintendent.
    b. Ready-mix concrete manufacturer.
    c. Concrete paving subcontractor.
    d. District's or Client's Representative
    e. Architect's Representative
    f. Inspector of Record
    g. Provide meeting minutes for pre-installation conference

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Proprietary admixtures, pigments, curing compounds, hardeners, sealers, form-release agents, etc.: Indicate compatibility with other materials used.

B. Samples for Initial Selection: For each type of product, finish, ingredient, or admixture requiring color selection.

C. Design Mixtures: Submit proposed mix designs and test data for each class of concrete and for each method of placement.
   1. Prepare mix designs on the basis of field experience (preferred) and/or trial mixes, in compliance with California Building Code (CBC), Section 1903A.
   2. Mix designs shall be prepared, stamped and signed by a structural or civil engineer registered in the State of California.
      a. Mix designs shall be reviewed by the Architect (AOR) and Structural Engineer of Record (SEOR).
   3. Identify for each mix design submitted the method by which proportions have been selected.
      a. For mix designs based on trial mixtures, include trial mix proportions, test results, graphical analysis and show required average compressive strength f'c results. Provide gross weight and yield per cubic yard of trial mixes.
      b. Indicate quantity of each ingredient per cubic yard of concrete and percentages.
      c. Indicate type and quantity of admixtures proposed or required.
      d. Indicate water to cement ratio by weight.
      e. Measured slump.
      f. Measured air content.
      g. Provide shrinkage test results.
   4. Multiple mix designs or multiple manufacturers shall not be permitted for the same application.

D. Provide maximum 5% fly ash; ground granulated blast-furnace slag, and/or silica fume content as Portland cement replacement in all concrete.

E. Submit proposed alternate design mixtures for review by the Architect and SEOR when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

F. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Shop drawings should include details such as reveals, recessed lights, handrails, or other elements requiring steel coordination.

1. Coordinate with and identify the details of the Contract Drawings on the shop drawings.
2. Comply with ACI 315, part B and CRSI requirements.

G. Construction Joint Layout: Indicate proposed construction joints required to construct the structure. Submit dimensioned drawing indicating layout of construction joints, contraction (control) joints, dowelled joints, decorative scoring and placement sequence of concrete if different than layout indicated on plans.
1. Location of construction joints are subject to approval of the Architect.
2. All form seams are to align with construction joints or reveals.

H. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.

I. Qualification Data: For qualified ready-mix concrete manufacturer (batch plant) and installer of detectable warnings.

J. Welding Certificates: Submit certifications signed by AWS Certified Welding Inspector of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualifications of welding operators and qualifications of welders.

K. Material Certificates: For the following, submit manufacturer data, test results, and technical information for aggregate, sand and cement, submit ½ cubic foot physical sample. For sealant submit manufacturer color standard and custom palette together with physical samples:
1. Cementitious materials.
2. Aggregates and sand.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent and epoxy adhesives.
8. Joint fillers.
9. Sealer
10. Sealant.

L. Material Test Reports: For each of the following:
1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

M. Field quality-control reports.
1. Submit copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to the site. Tickets shall include all information required by the referenced standard.

N. Minutes of pre-installation conference.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with CBC Chapter 19A.
1. Chemical products field-applied to concrete shall comply with the air quality requirements of authorities having jurisdiction.
2. Comply with requirements of local, State and other authorities having jurisdiction for work performed within public right-of ways.

B. Industry Standards: Comply with the following <u>unless modified by requirements in the Contract Documents.(Plans and specifications)</u>
1. ACI 301, "Specifications for Structural Concrete".
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".
3. ACI 302.1R, "Guide for Concrete Floor and Slab Construction".

4. ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete".
5. ACI 305R, "Hot Weather Concreting".
6. ACI 306.1, "Standard Specification for Cold Weather Concreting".
7. ACI 318, "Building Code Requirements for Structural Concrete".
8. ACI 347, "Guide to Formwork for Concrete".
9. ACI SP-66, "ACI Detailing Manual".
10. CRSI, "Manual of Standard Practice".
11. CRSI, "Placing Reinforcing Bars".

C. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

D. Source Limitations for Concrete Paving: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties. Secure all material required for the duration of the project as needed to ensure consistent quality in appearance.

E. Welding Qualifications: Comply with CBC Chapter 17A.
   1. Qualify welding procedures and welding personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel" prior to performing any welding.
   2. Qualify welding inspection personnel according to AWS QC1, "Standard for AWS Certification of Welding Inspectors."

F. 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.

G. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

H. ACI Publications: Comply with ACI 301 unless otherwise indicated.

I. Mockups: Before casting concrete paving, build mockups to verify selections made under Sample submittals and to fully demonstrate typical joints (including expansion and saw cut joints), surface finish, texture, color tolerances, standard of workmanship and completed product. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
      a. Paving Modules: Construct at least one 4 ft. x 4 ft. mockup of each color, finish, and mix design of special paving module, including stenciled areas, banding and curbs
   2. Build mockups full-size, matching site concrete components indicated on the Drawings. Mock-ups shall be complete in every detail, including joints, reveals, edges, chamfers, etc. Include complex joinery conditions where necessary to integrate to other Project components as indicated including multiple pour conditions. Mockups should be provided for each finish, color, joint and detail specified.
   3. Maintain accurate records of variables associated with each mockup to facilitate the matching of accepted mockups during actual construction.
   4. Demonstrate curing, cleaning, and protecting of cast-in-place concrete paving, finishes, and contraction and expansion joints, as applicable.
   5. Mockup Acceptance: Obtain Architect's approval of mockups before casting architectural site concrete and paving.
      a. The Architect may reject mockups that, in the Architect's sole judgment, do not demonstrate an acceptable completed product, including, but not limited to, color, joint work, surface finish, texture, tolerances, and standard of workmanship
      b. The Architect may require modifications to mockups to obtain acceptable results.

c. The Architect may require modifications to mockup repairs to obtain acceptable results.
d. The Architect may require removal and reconstruction of mockups to obtain acceptable results. Multiple mock ups maybe required.
e. Contractor shall provide additional mockups as required to obtain results acceptable to the Architect at no additional cost to the Owner.

6. Mockup Disposition: Accepted mockups shall not become part of the completed Project. Maintain mockup onsite for the duration of construction and until all work has been accepted. Remove and legally dispose mockups after acceptance of final installed work. prior to Project Completion. If sufficient permanent concrete paving work has been completed, Contractor may submit a written request to Architect to transfer quality control for concrete paving from the accepted mockups to one or more designated portions of the permanent work.
7. Provide written meeting minutes for each mock up review indicating items reviewed, approvals, rejections, connections, or other action items.

1.07 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending, damage, and rust.
1. Label bundles with durable identification tags. Maintain reinforcement identification after bundles are broken.
2. Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening contaminants.
3. Avoid damaging applied coatings, if any, on steel reinforcement.

PART 2 - PRODUCTS

2.01 FORMS

A. Formwork: / Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth surfaces.
1. Set forms to alignment, grade and required dimensions. Formwork shall not deviate more than 1/4 inch from required vertical positions and 1/4 inch from required horizontal positions. Exposed Surfaces: Provide faced plywood panels complying with, or equivalent to, DOC PS 1, Structural I. Provide minimum 7-ply plywood and provide balance sheets for panels coated one-side only. Furnish in largest practicable sizes to minimize number of joints. Provide Medium-Density Overlay (MDO) panels or high density overlay (HDO) panels, with mill-applied release agent and edge sealant. Provide one of the following panels, or comparable substituted product:
a. Olympic Panel Products, "B-Matte 333 MDO Concrete Form." Overlay Color: Brown.
b. Pacific Laminate Products, "ProFace MDO." Overlay Color: Black.
c. Sylvan Products, LLC, "Armor Ply MDO" Overlay Color: Brown.
2. Hold forms rigidly in place by stakes, clamps, spreaders, and braces at 3 feet on centers, and where required to ensure rigidity.
3. 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.

4. Place joint filler or backer rod on vertical surfaces in contact with concrete paving.
5. Benders or thin plank forms may be used on curves, grade changes, or curb returns. Back forms for curb returns may be made of ½-inch thick benders cleated together for full depth of the curb.
6. Keep forms in place until concrete is sufficiently hard to prevent damage to concrete.
7. Reuse of Forms:
   a. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of surface or edge.
   b. Thoroughly clean and properly coat forms before reuse.
   c. Do not use forms from previous projects.
8. Provide new forms specifically purchased for this project. Reuse of forms from past projects or contractors stock will not be accepted.

B. Curved Work: Kerf back of plywood form-facing panels, or use accepted flexible or curved forms for curved work with a radius of 100 feet or less.

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.
   1. Obtain written acceptance of form release agent from integral colored concrete pigment manufacturer.
   2. Form-release agents shall be non-staining and can cause no visual effect to the finish.
   3. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.02 STEEL REINFORCEMENT

A. Recycled Content: Provide steel reinforcement with an average recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 60 percent.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

F. Low-Alloy-Steel Reinforcing Bars (for Welding): ASTM A 706/A 706M, Grade 60, deformed, unless otherwise indicated.

G. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
   1. Provide two-component "Speed Dowel System" manufactured by Greenstreak.

H. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

I. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

J. 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.

K. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

L. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

M. Zinc Repair Material: ASTM A 780.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, Type II/V, Type I/II or Type IV, gray, unless white cement is required to achieve colors indicated.
      a. Fly Ash: ASTM C 618, Class F.

B. Normal-Weight Aggregates: ASTM C 33, complying with building code. Provide aggregates from a single source. All aggregates shall be free of materials with deleterious reactivity to alkali in cement when tested in accordance with ASTM C 289.
   1. Comply with CBC section 1903A.
   2. Maximum Coarse-Aggregate Size: 1 inch nominal.
      a. Source: Reliance, Vulcan, San Gabriel, or Carrol Canyon
      b. Hard rock mix; no pea gravel will be accepted.
   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
      a. Source: Reliance, Foster, Corona
      b. Color to be white to light no dark material.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Shrinkage-Reducing Admixture: Commercially formulated, shrinkage inhibitor capable of reducing initial shrinkage by 80% and long-term shrinkage by 50%. Provide product suitable for use with either air-entrained or non-air-entrained concrete as appropriate to structural member and project location.
   1. Products: Subject to compliance with requirements, provide the following(as required):
      a. Meet ASTM C494 requirements
         1) Euclid Chemical Company (The), an RPM company; EUCON SRA, SRA+.
         2) Grace Construction Products, W. R. Grace & Co.; Eclipse Floor, Eclipse Plus.
         3) Sika Corporation; Control 40.

2.04 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete. Provide products with not more than 100g/L volatile organic content.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals, LLC; Confirm.
      b. Conspec by Dayton Superior; Aquafilm.
      c. Nox-Crete Products Group; MONOFILM.

E. Clear, Waterborne, Membrane-Forming Curing Compound (Colored Concrete): Provide products that are acceptable to concrete color pigment manufacturer complying with ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of sealers with no glossy finish and compatible with specified sealer. Provide products with not more than 100g/L volatile organic content.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Sinak Corporation; The Cure WCE or Lithium Cure 1000.
   b. L. M. Scofield; Cureseal-W.
   c. Butterfield Color; Clear Guard H2O.

F. All curing materials should be dissipating without leaving a shiny, cloudy, or glossy finish. Curing material does not substitute requirement of a sealer.

2.05 HARDENERS AND SEALERS

A. Penetrating Liquid Floor and Horizontal Surface Treatment (Sealer): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate water-based lithium quartz materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. Materials hsall be compatible with concrete admixtures and shall be recommended by manufacturer for intended use. Provide product with 0g/L volatile organic content.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sinak Corporation; Concrete Sealer HLQ 125.
      b. L. M. Scofield; Cureseal-W.
      c. L&M Construction Chemicals, Inc.; Seal Hard.

2.06 AGGREGATE BASE

A. Granular Fill: Class II crushed aggregate per Section 26 of Cal-Trans standards. Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm), 20 to 10 / 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 0-5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.07 RELATED MATERIALS

A. Joint Fillers:
   1. Ceramar by W.R. Meadows. A closed cell isomeric polymer synthetic foam ASTM D 5249, Type 2 .
   2. Deck-O-Foam polyethylene by W.R. Meadows. A closed cell expansion joint fille ASTM D 4819
   3. 1/4" thickness.

B. Bonding Agent: ASTM C 1059, Type II, non-re-emulsifiable. Provide proprietary products composed of latex polymers.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. W. R. Meadows, Inc.; “Acry-Lok”.
      b. Grace Construction Products, W. R. Grace & Co.; "Daraweld C".
      c. Larsen Products Corp., "Weld-Crete".

C. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete, and for anchoring dowels to hardened concrete.

2.08 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 5-1/2 to 6 inches high by 7 inches wide by 48 inches long at singles stalls and 72 inches long at shared stalls.

Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Dowels: Galvanized steel or rebar, 1/2 inch in diameter, 18-inch minimum length.

2.09 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), 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.
   2. Proportioning:
      a. The proportioning of ingredients shall be such that the concrete can be readily worked into forms and around reinforcement under the conditions of placement to be used, without segregation or excessive bleeding.
      b. When proportioning by weight of loose, dry material, 94 pounds of cement shall be considered 1 cubic foot.
         1) Float/Broom Finish: Coarse aggregate 50 percent-50 percent fine aggregate.
         2) Retarder finish: Coarse aggregate 40 percent, fine aggregate 60 percent.
      c. Total water content shall not exceed 35 gallons per cubic yard of concrete.
      d. Weighing equipment shall be accurate within 1 pound and shall be adjustable for varying aggregate moisture content.
      e. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment.
   3. Prepare compressive strength data for both 7-day and 28-day strengths.
      a. The 7-day compressive strength shall be at least 60 percent of the required 28- day strength.
      b. The 28-day compressive strength shall be as indicated.
      c. Provide drying shrinkage test data at 28 days, from not less than 3 test specimens.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Typical Compressive Strength (28 Days): Provide the following minimum compressive strength (28 days) for concrete paving unless otherwise indicated: 3000 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50-0.60.
   3. Slump Limit: 4 inches, plus or minus 1 inch, unless indicated otherwise.
      a. Slump Limit (High-Range Water-reducing Admixture): 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture, plus or minus 1 inch, unless indicated otherwise.

C. Air Content, Exterior Exposed Concrete: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having the following air entrainment for all exposed concrete with a weathering probability of severe or moderate per ACI 318-19 Section 26.4.1.4:
   1. Provide air entrainment of 6.0 percent, plus or minus 1.5 percent at point of delivery for 1-inch and 3/4-inch nominal maximum aggregate size, if required unless indicated otherwise.

D. Limit "drying shrinkage" after 28 days of curing hardened concrete to 0.045 percent of the original concrete volume.

E. Limit water-soluble, chloride-ion content in hardened concrete to [0.15] [0.30] percent by weight of cement.

F. Chemical Admixtures: Admixtures may only be used if they are incorporated into the accepted concrete mix designs. Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 and 90 deg. F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg. F (32 deg. C), reduce mixing and delivery time to 60 minutes.

B. 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

3.01 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 concrete paving with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
   2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 31 22 00 "Grading".

C. Proceed with concrete paving installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 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.

C. Slope stair and step treads at not less than 1.0 percent and not more than 2.0 percent cross slope to drain.

3.04 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 fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation or expansion joint, and saw cut / 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. Isolation (Expansion) Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 20 feet maximum unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint and recess 1 inch from finish surface where no joint sealant is indicated.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   5. Break steel at expansion joints.
   6. Dowels- provide prefabricated 'speed dowel' assemblies.

C. Saw Cut (Control) Joints: Form weakened-plane saw cut joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth plus 1/4 inch of the concrete thickness, as follows, and to match jointing of existing adjacent concrete paving:
   1. Continue steel reinforcement across sawcut joints unless otherwise indicated.

D. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/8-inch radius unless otherwise noted. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in. Notify other trades as necessary to permit installation of their work.

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. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. 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, and side forms. Use only

square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather 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 (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg. F (10 deg C) and not more than 80 deg. F (27 deg C) 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.

M. Hot-Weather Placement: Comply with ACI 305R (ACI 305R M) and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg. F (32 deg C) 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.

N. Provide sand and base materials as indicated.

3.07 **FLOAT/BROOM FINISHING**

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
   2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture. Required to meet slip coefficient requirement.
   3. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with **CBCSections 11B-302** and **11B-403**.

3.08 CONCRETE PROTECTION, CURING AND SEALING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

F. Seal Concrete: Apply specified sealer in accordance with manufacturer’s recommendations.
   1. Apply full strength in two coats with airless sprayer at the manufacturer’s recommended rate.
   2. After the first coat is completely dry, apply second coat at right angles to the first coat.

3.09 PAVING TOLERANCES

A. Comply with tolerances in ACI 117, the Americans with Disabilities Act, the CBC and as follows:
   1. Elevation: 1/8 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/8 inch. Surface must properly drain.
   4. Surface Discontinuities: Maximum 1/4 inch, subject to further limitations of accessible routes.
   5. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   6. Lateral Alignment and Spacing of Dowels: 1/4 inch.
   7. Vertical Alignment of Dowels: 1/8 inch.
   8. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/8 inch per 12 inches of dowel.
   9. Joint Spacing: 3 inches, except joint position shall be within 1/4 inch of objects in alignment with joint such as benches, light poles, pull boxes, etc.
   10. Sawcut Joint Depth: Plus 1/4 inch, no minus.
   11. Joint Width: Plus 1/16 inch, no minus.

B. Stair Treads: Stair treads within a run shall be constructed equally and shall shed water away from the path of travel. Maximum tread slope down from riser to nosing in direction of travel: 1.0

percent, plus or minus 0.5 percent. Maximum tread cross-slope perpendicular to direction of travel: 1.8 percent, plus 0.2 percent, minus 1.0 percent or as required to shed water.

C. Ramps: Ramps shall shed water away from the path of travel. Maximum ramp slope in direction of travel: 8.33 percent. Maximum ramp cross-slope perpendicular to direction of travel: 1.8 percent, plus 0.2 percent, minus 1.0 percent or as required to shed water.

3.10 WHEEL STOPS

A. Securely attach wheel stops to paving with not less than two #4 galvanized steel dowels or rebar, minimum 18 inches long, located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

B. Install preformed speed [bumps] in bed of adhesive applied as recommended by manufacturer for heavy traffic.

C. Securely attach preformed speed [bumps] to paving with hardware spaced as recommended by manufacturer for heavy traffic. Recess head of hardware beneath top surface.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 20 cu. Yd., or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; 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 C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 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.

C. 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.

D. Test results shall be reported in writing to Owner, 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.

E. 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.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, cracked, chipped, stained or defective or that does not comply with requirements in this Section as determined by Landscape Architect. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude all but pedestrian traffic from paving for at least 28 days after placement. When construction traffic is permitted, maintain paving as clean as possible by providing adequate surface protection and by removing surface stains and spillage of materials as they occur.

1. Rubber tire marks are unacceptable in the completed construction.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Project Completion inspections.

E. Repair of damaged, defective or rejected concrete is not permitted. Remove all concrete from expansion joint to expansion joint or greater as required to provide a constant continuous finish.

3.13 FINAL CLEANING

A. Remove all excess concrete, form materials, over pours, waste, etc., and legally dispose off-site.

B. Provide a final acid and power wash for all concrete paving surfaces. Do not use any material that will affect the appearance of the concrete.

C. All over pours in planting areas should be removed prior to landscape operations.

D. Clean concrete paving to remove stains, markings, dust, and debris.

END OF SECTION 321313

SECTION 321373
PAVEMENT JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES: RELATED DOCUMENTS

A. Exterior joint sealant for non-traffic surfaces.

1.02 RELATED REQUIREMENTS

A. Division 32 Section Concrete Paving.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-), and 1/4-inch (6.4-mm) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

D. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

C. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

D. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

E. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

F. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

B. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).

C. When joint substrates are wet or covered with frost.

D. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

E. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Landscape Architect from manufacturer's full range.

2.03 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Multicomponent Pourable Urethane Sealant (Sealant #1):
   1. Available Products:
      a. Bostik Findley; Chem-Calk 550.
      b. Meadows, W. R., Inc.; Pourthane.
      c. Pacific Polymers, Inc.; Elasto-Thane 227 Type I (Self Leveling).
      d. Pecora Corporation; Urexpan NR-200.
      e. Polymeric Systems Inc.; PSI-270SL.
      f. Schnee-Morehead, Inc.; Permathane SM 7201.
      g. Sika Corporation, Inc.; Sikaflex - 2c SL.
      h. Sonneborn, Division of ChemRex Inc.; SL 2.
      i. Tremco; THC-900/901.
      j. Tremco; Vulkem 245.
   2. Type and Grade: M (multicomponent) and P (pourable).
   3. Class: 25.
   4. Use Related to Exposure: T (traffic).

5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

D. Multicomponent Nonsag Urethane (Sealant #2):
1. Available Products:
a. Pacific Polymers, Inc.; Elasto-Thane 227 High Shore Type II (Gun Grade).
b. Pecora Corporation; Dynatred.
c. Polymeric Systems Inc.; PSI-270.
2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

F. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

3.06 SCHEDULE

A. Horizontal Joints, less than 5 percent slope; Sealant No. 1.

B. Horizontal Joints, grades steeper than 5 percent; Sealant No. 2

C. Vertical Joints; Sealant No. 2

END OF SECTION 321373

SECTION 321413
PRECAST CONCRETE UNIT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interlocking concrete paver units.

B. Sand setting bed.

C. Sand joint filler.

D. Aggregate fill.

E. Topsoil filler.

F. Edge restraints.

1.02 RELATED REQUIREMENTS

A. Section 312200 - Grading: Preparation of subsoil for pavers.

B. Section 321123 - Aggregate Base Courses: Aggregate subbase for pavers.

1.03 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

B. ASTM C936/C936M - Standard Specification for Solid Concrete Interlocking Paving Units; 2023a.

C. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping and Construction Purposes; 2023.

1.04 **QUALITY ASSUARANCE**

A. Source Limitations: 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.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at work site.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide characteristics of paver unit, dimensions, and special shapes.

C. Samples: Submit two samples of each paver type, illustrating style, size, color range and surface texture of units being provided.

D. Manufacturer's Installation Instructions: Indicate substrate requirements and installation methods.

E. Maintenance Materials: Provide the following for Owner's use in maintenance of project.

1. Extra Pavers: 10 of each type and size.

1.06 **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 aggregates where grading and other required characteristics can be maintained and contamination avoided.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interlocking Permeable Concrete Pavers: The design is based on the following product: Orco EcoHex .

2.02 MATERIALS

A. Interlocking Concrete Pavers: Hydraulically pressed concrete, configured for interlocking with adjacent units and complying with ASTM C936/C936M.

B. Sand for Setting Bed: Clean washed natural sand or crushed stone, free from deleterious or foregin matter complying with gradation requirements of ASTM C33/C33M for fine aggregates.
   1. Do not use mason sand or sand conforming to ASTM C 144 for the bedding sand.

C. Sand for Joints: Fine washed sand with 70 to 100 percent passing No. 16 sieve and not more than 5 percent passing No. 200 sieve. ASTM C 144 ASTM C 144.

Sieve Size	Percent Passing
No. 4 (4.75 mm)	100
No. 8 (2.36 mm)	95 to 100
No. 16 (1.18 mm)	70 to 100
No. 30 (0.600 mm)	40 to 75
No. 50 (0.300 mm)	10 to35
No. 100 (0.150 mm)	2 to 15
No. 200 (0.075 mm)	0 to 5

D. Aggregate base for subbase: Refer to specification section 321123 Aggregate Base Courses.

E. Edging: Concrete curb, as detailed.

2.03 **ACCESSORIES**

A. Sealers:
   1. Surebond SB-1300

B. 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 (0.425-mm) sieve, maximum; ASTM D 4751.
   3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
   4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.

PART 3 EXECUTION

3.01 EXAMINATION

A. With the installer present, verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this Section.

B. Verify gradients and elevations of substrate are correct.

C. Verify dry weather forecast without rain for a minimum of 24 hours with temperatures above 55 degrees Fahrenheit.

D. Proceed with installation only after unstatifactory conditions have been corrected.

3.02 PREPARATION

A. Where aggregate subbase is required, proof roll subgrade to identify soft pockets and areas of excess yeilding. Proceed with precast concrete paver installation only after deficient subgrades have been corrected and ready to recieve subbase and base courses for concrete pavers.

B. Treat leveling course to retard plant growth.

3.03 EDGING INSTALLATION

A. Install edging prior to placing unit pavers.

3.04 INSTALLATION OF SOLID PAVER UNITS

A. Place geotextile over compacted base course/compacted subgrade.
   1. Overlap edges of geotextile by 12 inches minimum.

B. Spread sand bedding evenly over prepared substrate surface to a maximum thickness of 1-1/2 inch.

C. Dampen and roller compact sand to level and even surface.

D. Screed and scarify top 1 inch to 1 1/2 inch of sand.

E. Place paver units in standard hex pattern creating staggered joints, from straight reference edge.

F. Cut paver units at edges with masonry saw.

G. Place half units at edge and interruptions. Maintain tight joints.

H. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

I. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

J. 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.

K. Sprinkle sand over surface and sweep into joints. Moisten joints and recover with additional sand until firm joints are achieved. Remove excess sand.

L. Tamp and level paver units with mechanical vibrator until units are firmly bedded, level, and to correct elevation and gradients. Do not tamp unrestrained edges.
   1. 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.

2. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
3. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
4. 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.
5. 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.

M. Spread dry joint 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.

N. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.

O. Tolerances: 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.

P. Do not allow traffic on installed pavers until sand has been vibrated into joints.

Q. Repeat joint-filling process 30 days later.

3.05 CLEANING

A. Do not clean pavers until pavers and mortar are dry.

B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.

C. Use non-metallic tools in cleaning operations.

D. Rinse surfaces with clean water.

E. Broom clean paving surfaces. Dispose of excess sand.

3.06 PROTECTION

A. Do not permit traffic over unprotected paver surface.

B. Protect paver surface with sheets of plywood.

3.07 **REPAIRING**

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.

END OF SECTION 321413

SECTION 321813
SYNTHETIC TURF SURFACING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. SECTION INCLUDES
   1. Synthetic turf surfacing for football, flag football, and soccer field.
      a. Subgrade preparation
      b. Aggregate Base
      c. Subsurface drainage system
      d. Synthetic turf
      e. Perimeter edge nailer
   2. Dynamic base under synthetic turf system, including:
      a. Excavation, backfilling and compaction to achieve stable, impermeable subgrade.
      b. Construction of perimeter drainage collector network and drainage grid system.
      c. Construction of a stable and permeable aggregate layer.

B. RELATED SECTIONS
   1. Division 31 section "Earthwork," for general requirements applicable to substrate preparation at areas to receive synthetic turf system.
   2. Division 33 section "Storm Drainage System," system to which drainage system under synthetic turf is connected.
   3. Division 32 section "Concete Paving" for concrete curbing.

C. REFERENCES
   1. FM P7825 - Approved Guide; Factory Mutual Research Corporation; current edition.
   2. ASTM Standard Test Methods:
      a. D1577 - Standard Test Method for Linear Density of Textile Fiber
      b. D5848 - Standard Test Method for Mass per Unit Area of Pile Yarn Floor Covering
      c. D418 - Standard Test Method for Testing Pile Yarn Floor Covering Construction
      d. D1335 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
      e. D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
      f. D8034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
      g. F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
      h. D4491 - Standard Test Method for Water Permeability of Geotextiles by Permittivity
      i. D2859 - Standard Test Method for Ignition Characteristics for Finished Textile Floor Covering
      j. F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces
      k. F1936- Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field.
      l. D1557 - Test Method for Laboratory Compaction Characteristics of Soil

m. D5034 - Standard Test Method for breaking strength and elongation of textile fabrics (area test)
n. D1338 - Standard Test Method for tuft bind of pile yarn floor covering
o. F2117 - Standard Test Method for vertical rebound characteristics of sports sufacing systems: accoustical measurments(soccer)
p. F1551-03 - Suffix: DIN 18-035, Part 6: Water permeability of synthetic turf systems.
q. Surface Systems: Acoustical measurements (soccer)
r. BS7044 Section 2.2: Methods for determination of person/surface Interaction Method 1: Determination of traction (notational resistance)

3. Most recent National Federation of High School Rules and California Interscholastic Federation as applicable.

1.03 SYSTEM DESCRIPTION

A. Synthetic Turf System:
1. Finished playing surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types.
2. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields.
   a. Finished surface shall resist abrasion and cutting from normal use.
   b. System shall be suitable for football, flag football, soccer, an dmarching band activities.
   c. Activity levels shall encompass physical education classes, intramural teams, interscholastic competitive teams and community recreational usage.
3. Materials shall withstand full climatic exposure of locale in which project is located and shall have the following characteristics:
   a. Be resistant to insect infestation, rot, fungus and mildew.
   b. Be resistant to ultra-violet light and heat degradation.
   c. Have basic characteristic of flow-through drainage, allowing free movement of surface run-off vertically through synthetic turf system, where such water may flow through the permeable subbase and into field drainage system.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive data for geotechnical fabric and subsurface drainage system components.

B. Compaction report: Geotechnical engineering consultant will submit a soil compaction report prior to placement of concrete fabric, turf and excavation of footings in accordance with requirements of the California Building Code (CBC) Article 1701A, and Title 24, Part 2, Section 3301.1.

C. Shop Drawings: Complete for entire field and including the following:
1. Role/seaming plan.
2. Installation details, including edge details, attachments and penetrating elements, such as goal posts.
3. Composite striping and field layout plan and details, to show all game event lines, markings and boundaries as indicated on the Drawings.
4. Delineate colors, which markings are painted versus inlaid fabric, and which markings are inlaid fabric versus tufted-in fabric for line striping.
5. Logo.

D. Test Data: Certified test reports by third-party agency, reporting the following for synthetic turf to be provided:
1. Pile height, face weight and total fabric weight: Per ASTM D 418.
2. Primary and secondary backing weights: Per ASTM D 418.

3. Tuft bind: ASTM D 1335.
4. Grab tear strength: ASTM D 1682.
5. Dynamic cushion test: ASTM F 355, Procedure A (system).

E. Installation Instructions: Complete instructions for preparation and installation of all components.

F. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices, to be included in binder as specified in Section 01783 - Operation and Maintenance Data. Include instructions for proper care and preventative maintenance of synthetic turf system, including painting, grooming, sweeping, vacuuming and striping.

G. Project Record Drawings: Accurately record location of all underground utilities, landscape irrigation system piping and control wiring, and changes in finish elevations and gradients which materially affect drainage. Comply with requirements specified in Division 01 - Section: Project Record Documents.

H. The turf manufacturer, fiber manufacturer name, type of fiber, composition, and extrusion process.

I. Percolation test data for the drainage course.

J. 12”X12” turf samples of all specified colors including striping, turf, and logo.

K. Certified copies of independent (third party) laboratory reports on ASTM testes.
1. Pile height, face or pile weight and total fabric weight, ASTM D418 or D5848
2. Primary and secondary backing weights, ASTM D418 or D5848
3. Grab tear strength ASTM D1682 or D5034

L. G-max test data.

M. Submit data in sufficient detail to indicate compliance with the contract documents.

N. Product Certification: Submit manufacturer’s certifications that product and materials comply with requirements of the specifications.

O. List of existing installations: Submit list including owner’s representative and telephone number.

P. Warrantees: Submit warranty and ensure the forms have the owner’s names and have been registered with the approved manufacturers and companies.

Q. One pound of each specified infill material size and type.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with Sections 200, 211, 300 and 301 in the Standard Specifications for Public Works Construction (SSPWC) and requirements of the authorities having jurisdiction.
1. Accessibility: Provide artificial turf determined to be accessible when tested according to ASTM F 1951 (formerly ASTM PS 83) and designed to comply with requirements for an accessible route as required by California Building Code (CBC), Chapter 11B.
2. Wheelchair Accessibility: For synthetic turf surfacing indicated in accessible paths of travel for wheelchairs, surfacing shall be fire stable and slip-resistant, and shall comply with requirements of FED-STD-795, 28 CCRF Part 36, ASTM F 1487, ASTM F 1292 and California Building Code (CBC).

B. Manufacturer's Qualifications: Successfully produced and installed specified products for minimum of ten projects in past three years in California, of comparable scale to those required by the Contract under the same name and with the same fiber manufacturer.

C. Installer's Qualifications: Installation shall be by manufacturer of synthetic turf system. Installer shall employ only qualified, experienced supervisors and technicians skilled in installation of specified synthetic turf system. Submit resumes of key installation personnel upon request of Architect.

D. Source Quality Control: Obtain materials from one source throughout.

E. Sample Warranty: Note all exclusions and exceptions.

F. Pre-installation conference: Conduct conference at project site at a time to be determined by Architect. Contractor is to request, coordinate and document meeting in formal meeting minutes. Review methods and procedures related to installation including but not limited to, the following:
   1. Review and discuss existing conditions and preparation work performed under other contracts.
   2. Arrange for attendance of other installers and trades affected by the work.

G. Contractor shall verify special conditions required for the installation of the system.

1.06 PROJECT CONDITIONS

A. Soil Conditions: Refer to Geotechnical Data for report of subsurface investigation by District and made available to Contractor.
   1. Additional subsurface investigations determined as necessary by manufacturer of synthetic turf system shall be performed by Contractor, at no additional cost to the Owner.
   2. Should subsurface investigation at locations to receive synthetic turf differ significantly from those reported in the geotechnical report referenced as Geotechnical Data, provisions of the Conditions of the Contract, for unforeseen conditions, shall govern.
   3. Provide 6-onsite percolation tests on the installed and compacted base material meeting the manufacturer’s required percolation rate.

B. Environmental Requirements for Synthetic Turf Installation: Comply with manufacturer's instructions and recommendations for ambient and surface temperatures and for humidity at time of installation.

1.07 WARRANTY

A. Manufacturer's Extended Warranty: Cover materials and workmanship and warrant that synthetic turf system shall meet the following criteria for a period of not less than eight years from date of Project Completion.
   1. Materials and installation meet or exceed specified characteristics.
   2. Warranty covers all self-manufactured and procured materials.
   3. Synthetic turf system shall function for specified uses.
   4. Third party insured, non-prorated and non-cancelable warranty pre-paid for 8 years from no lower than an ‘A’ rated insurance company. The policy must include an unlimited amount per claim. The policy must not have any epidemic failure limitations or restrictions. The policy must not have any deductible and the coverage must be for labor, materials and any other costs to repair or replace each field per the warranty certificate. Policy must cover full 100% replacement value of total square footage installation.
   5. Replacement materials for synthetic turf system shall be available during warranty period.
   6. Synthetic turf system shall maintain ASTM F 355 G-max between 125-175 for the life of the installation.

B. Installer's Extended Warranty: Cover defects in installation and warrant that installation was performed in compliance with manufacturer's instructions and recommendations, for period of time matching manufacturer's guaranty and with same criteria specified above for manufacturer's guaranty.

C. Limitations: Third party warrantee, Manufacturer's Extended Warranty and Installer's Extended Warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor and the manufacturer under the Contract Documents and governing laws.

1.08 SEQUENCING AND SCHEDULING:

A. Coordinate and make necessary accommodations for other trades and/or contractors.

B. Sequence work in order of prevent deterioration of the installed system.

1.09 QUALITY CONTROL IN MANUFACTURING

A. The manufacturer shall own and operate its own manufacturing plant. Manufacturing the fiber, tufting of the field fibers into the backing materials and coating of the turf system must be done in-house by the turf manufacturer. Outsourcing of any of these major processes is unacceptable.

B. The manufacturer shall have full-time certified in-house inspectors at their manufacturing plant that are experts with industry standards.

C. Primary backing shall be inspected by the manufacturer's full-time certified in-house inspectors before tufting begins.

D. The manufacturer's full-time in-house certified inspectors shall verify "pick count", yarn density in relation to the backing, to ensure the accurate amount of face yarn per square inch.

E. The manufacturer's full-time, in-house, certified inspectors shall perform turf inspections at all levels of production including during the tufting process and at the final stages before the turf is loaded onto the truck for delivery.

F. The manufacturer shall have its own, in-house laboratory where samples of turf are retained and analyzed, based on standard industry tests, performed by full-time, in-house, certified inspectors.

G. The manufacturer must have ISO 9001, ISO 14001 and OHSAS 18001 certifications demonstrating its manufacturing efficiency with regards to quality, environment and safety management systems.

1.10 QUALITY CONTROL IN FIBER MANUFACTURING

A. Synthetic turf fiber must perform in a uniform manner or manufacturer quality control issues in the extrusion processes will be suspected. Linear Low Density Polyethylene Polymer ("LLDPE") and batch additives obtained from a reputable manufacturer are required to manufacture superior quality monofilament yarn. The master batch formula must include a UV stabilizer package added to its polymer base.

B. The LLDPE used to make the artificial grass fiber needs to be a "C6" LLDPE which contains 6 carbon atoms and 13 hydrogen atoms; A C6-based LLDPE produces strong and resilient artificial grass fibers over prolonged periods and thus should provide the basis for long term performance of the system.

C. Adequate UV protection is essential to the long-term durability of any artificial grass fiber. Typically, stabilizer packages for polyethylene fibers have three components that protect the fibers from degradation: (1) primary antioxidants; (2) secondary antioxidants; and (3) UV stabilizers (i.e., hindered amine light stabilizers ("HALS")). HALS are a particularly important aspect of the stabilizer package. A typical HALS concentration is 10,000 ppm. More developed HALS molecules are methyl stabilized to prevent from degradation.

D. Streaking refers to color variation in a field due to different degrees of fiber relaxation. Fiber in one row stands up, while fiber in an adjacent row lies flat. The inconsistent relaxation causes differences in the reflection of light off of the fiber, and results in the field having a streaked or striped appearance. Adequate UV protection minimizes the appearance of streaking and other visual flaws during the warranty period.

E. Each finished fiber should have at least 6 inner face support ridges and 10 outer face support ridges.

F. Ground surfaces on accessible routes, clear floor or ground spaces, and turning spaces for play areas shall comply with **CBC Section 11B-1008.2.6** as follows:

1. Ground surfaces shall be inspected and maintained regularly and frequently to ensure continued compliance with **ASTM F 1951.**
2. Ground surfaces located within use zones shall comply with **ASTM F 1292.**

PART 2 - PRODUCTS

2.01 SYNTHETIC TURF SYSTEM

A. Specified Manufacturer: FieldTurf USA, Inc., Calhoun, GA (760-635-2504).

B. Synthetic Turf System: Vertex Core, Cork Infill with Shockbase Pro
   1. G-max attenuation performance: Less than 125, at completion of installation, when tested according to ASTM F 355. Submit test report upon completion of installation verifying performance. G-max performance shall not change by more than 3.5 percent per year over life of the warranty with maximum value not to exceed 175.
   2. Color fading from UV exposure: Less than 6.5 per yarn specification testing standard (8 blue scales per yarn standard 8S1006).
   3. Field drain rate: 40-gallons/hour per square foot minimum.
   4. Blade and infill dimensions, appearance and surface texture/feel: Uniform with no evidence of seams, inlaid lines and other inlaid features.

C. Artificial grass FieldTurf system materials shall consist of the following:
   1. Carpet made of "spined and/or ridged" monofilament polyethylene fibers tufted into a fibrous, non-perforated, porous backing.
   2. Infill: Controlled mixture of graded sand and hemp that partially covers the carpet, with zeolite only at warning tracks as indicated on the drawings.
   3. Glue, thread, paint, seaming fabric and other materials used to install and mark the artificial grass monofilament FieldTurf.

D. The installed artificial grass monofilament AsroTurf shall have the following properties:

Standard	Property	Specification
ASTM D1577	Fiber Denier	10,800
	HALS UV Stabilizer	10,000ppm
	Inner Face Support Ridges	6
	Outer Face Support Ridges	10
ASTM D5823	Pile Height	2.25"
ASTM D5793	Stitch Gauge	3/4"
ASTM D5848	Pile Weight	36oz/square yard
ASTM D5848	Primary Backing	7oz/square yard
ASTM D5848	Secondary Backing	14+oz/square yard
ASTM D5848	Total Weight	57oz/square yard
ASTM D1335	Tuft Bind (Without Infill)	8+ lbs
ASTM D5034	Grab Tear (Width)	200 lbs/force
ASTM D5034	Grab Tear (Length)	200 lbs/force
ASTM D4491	Carpet Permeability	>40 inches/hour
ASTM F1936	Impact Attenuation (Gmax)	<200
	Infill Material Depth	1.5 inches
	Sand Infill Component	6.2lbs/square foot
	SBR Rubber Infill Component	2.2lbs/square foot

	Total Product Weight	1267oz/square yard

E. Carpet shall consist of spined and/or ridged monofilament fibers tufted into a primary backing with a secondary backing.

F. Carpet Rolls shall be 15' wide rolls.
   1. Rolls shall be long enough to go from field sideline to sideline.
   2. Where the playing field is for football, the perimeter white line shall be tufted into the individual sideline rolls.

G. Backing:
   1. Primary backing shall be a double-layered polypropylene fabric
   2. Secondary backing shall consist of an application of porous, heat-activated urethane to permanently lock the fiber tufts in place.
   3. Perforated (with punched holes), backed carpet are unacceptable.

H. Fiber shall be 10,800 denier, low friction, and UV-resistant fiber measuring not less than 1.5 & 2 inches high.
   1. Systems with less than a 2.25 inch fiber are unacceptable.

I. Infill materials shall be approved by the manufacturer.
   1. Infill shall consist of a resilient layered granular system, comprising selected, graded dust-free silica sand, cryogenically hammer-milled SBR rubber crumb and natural cork.
   2. Artificial Grass products without cryogenically processed rubber or a finish application of straight rubber cryogenically processed will not be acceptable.
   3. The sand component of the infill must represent a minimum of 51% or more of the total infill, by weight with adjustments made to compensate for the cork overlay.

J. Non-tufted or inlaid lines and markings shall be painted with paint approved by the synthetic turf manufacturer.

K. Thread for sewing seams of turf shall be as recommended by the synthetic turf manufacturer.

L. Glue and seaming fabric for inlaying lines and markings shall be as recommended by the synthetic turf manufacturer.

M. Infill Material: Specially-designed and produced sand ground-crumb rubber, and natural cork. Rubber particle size shall be 10-15 standard mesh gages.
   1. Standard in-fill depth: 1.75", resulting in a 3/4" standing blade height.
   2. Infill material shall be precision deposited in place at specified density to achieve optimum cushioning and response.
   3. Infill material shall be machine-brushed into turf to achieve uniform thickness, density and to secure material in place within blade fabric.

N. Lines and Markings: Non-tufted and non-inlaid lines and markings shall be applied with paint approved by synthetic turf manufacturer.

O. Installation Materials and Accessories:
   1. Thread: For sewing seams, as recommended by synthetic turf manufacturer.
   2. Adhesive: As recommended by synthetic turf manufacturer.
   3. Seaming fabric: As recommended by synthetic turf manufacturer.
   4. Field groomer: As recommended by synthetic turf manufacturer, with provision for towing behind field utility vehicle.
   5. Glued seams will not be permitted.

2.02 SUBSTRATE AND DRAINAGE MATERIALS

A. Granular Fill Materials: As specified in Division 31 Section "Earthwork", and as recommended by synthetic turf system manufacturer for proper drainage performance.

1. Granular fill: Class II permeable sub-base consisting of clean, well-graded, natural gravel or crushed stone, free of shale, clay, organic materials, and debris. Comply with requirements of synthetic turf manufacturer for particle size gradation.
2. Drainage fill: Rounded ¾-inch minus "pea gravel" for encasing perforated drainage piping.

B. Geotechnical Fabrics.
1. Geotextile Permeable Membrane: Mirafi 140N manufactured by Ten Cote Nicolan USA, woven polypropylene fabric with drainage performance of 130 gallons per minute per square-foot minimum.
2. Geotextile Non-Permeable Fabric Drainage Membrane:
a. Hercuscrim Scrim-reinforced LLDPE, Inline Plastics, LC, Houston, TX 77086 (800/364-7686).
b. 12 Mil fabric minimum.
c. All seams are to be heat welded/thermally fused.

C. Subdrainage Piping:
1. Specified manufacturer: Advanced Drainage Systems, Inc. (ADS), Hilliard, OH (800/821-6710; Western Zone office, Washougal, WA 800/733-8523).
2. Acceptable manufacturers: None identified.
3. Perforated flat drains: ADS AdvanEDGE® Pipe, 1-inch by 6-inch to 12-inch flat drain system, as identified on the Drawings and recommended by synthetic turf system manufacturer.
4. Fittings: Factory-manufactured couplings, wyes, caps and outlets to suit piping and project conditions.

D. Accessory Materials: Provide perimeter edge products and goal post foundations as indicated on the Drawings and as necessary complete and functional installation of synthetic turf system.
1. Perimeter nailer: For installation on concrete perimeter curb at field, 2-inch by 4-inch polymer composite lumber molding suitable for direct attachment of synthetic turf fabric.
2. Goal post foundation: Adapt existing goal post foundations to suit new synthetic turf system, including decay-resistant nailers fabricated to suit existing conditions.

E. Perimeter Trench Drain:
1. Permeable 12" styrene.
2. Encased in 3/4" minus pea gravel.

PART 3 - EXECUTION

3.01 SUBSTRATE PREPARATION

A. Substrate Preparation: Prepare substrate for synthetic turf as specified in Division 31 Section "Earthwork", and In accordance with the geotechnical report.
1. Excavate areas to receive synthetic turf to depth indicated on the Drawings.
a. Strip all grass other vegetation and dispose of legally off site.
b. Strip topsoil and stockpile it where directed for on-site re-use or, if not suitable for re-use, legally dispose off site.
c. All other excavated soil and rock shall be hauled off site and disposed legally, if not suitable for use on site as select-fill.
2. Based on determination by District's geotechnical engineering consultant, remove unsuitable soil and provide new select-fill.
3. Should over-excavation be necessary, provide select-fill material according to recommendations of the District's geotechnical engineering consultant, to achieve suitable substrate and design subgrade elevations.

4. Scarify, moisture condition and compact subgrade according to recommendations of referenced geotechnical report. Subgrade shall be graded to tolerance of 1-inch in 10-feet sloped 0.5 percent from center of field to sidelines and compacted to 95 percent relative density when testeded according to ASTM D 1557.
5. Construct drainage trenches to suit drainage lines.
6. Construct drainage trenches to suit drainage lines, according to synthetic turf system manufacturer's instructions and recommendations, to suit project conditions.
7. Construct substrate using select-fill material according to recommendations of Owner's geotechnical engineering consultant. Coordinate with installation of drainage lines and geotextile membranes.
   a. Place select-fill in lifts not greater than 6-inches in depth.
   b. Compact each lift (layer or course) separately.
   c. Moisture in soil, at time of compaction, shall be uniformly distributed and shall be within 90 to 120 percent of optimum.
   d. Within these limits, Owner's geotechnical engineer will determine proper moisture level to be used, by standard Proctor test.
8. Roll select-fill material in first layer until course has been uniformly compacted to minimum 95 percent of maximum density.
9. Place, mix and compact second and succeeding courses as specified for first course.
10. Proof roll and mark "soft spots" for additional compaction and other corrections as necessary, using suitable equipment. Proof rolling operations shall be performed in the presence of Testing Laboratory.

B. Geotextile Membrane Installation: Place non-permeable geotextile fabric in compliance with manufacturer’s instructions and recommendations.
   1. Install geotextile membrane draped and formed into perimeter drainage trenches. Trench fabric shall be placed in position first, with field fabric placed over it and overlapping minimum of 2 feet.
   2. Above completed and filled drainage trench, installed high-permeability fabric over drainage trench aggregate to prevent mixing of field base aggregate with trench aggregate.
   3. Prepared soil subsurface shall be isolated from installed field and drainage system above it with water and air permeable fabric membrane placed across the entire surface of the field, to ensure no mixing of soil subsurface with aggregate drainage system, yet to allow water and air passage.
   4. All seams under the field are to be heat welded/thermally fused using equipment and process approved by the manufacturer.

3.02 SUBSURFACE DRAINAGE SYSTEM

A. Subsurface Drainage System: Install subsurface drainage system and connect to site storm drain system, in accordance with manufacturer's instructions and recommendations and details indicated on the Drawings.
   1. Construct perimeter drainage trench nominally per plans sloped to drain.
   2. Field flat drainage shall consist of angled lines placed at 20-foot intervals and placed on geotextile membrane. Inset flat drains below the level of the subgrade over the impermeable membrane.
   3. Drain lines shall start at field crown line and angle 40-feet towards perimeter drainage trench.
   4. Isolate drainage trench from surrounding soil and field base aggregate.
   5. Drain line ends shall be draped into drainage trench and attached to 12-inch trench drain pipe.
   6. Trenches shall have slope to drain of 1 percent, typically, with minimum slope of 0.5 percent.

7. Run drain line to point of connection to underground storm drain line, manhole or outlet to approved drainage channel, not exceeding 200 feet run for 0.5 percent slope and 300 feet for 1 percent slope.

3.03 AGGREGATE BASE PLACEMENT AND GRADING

A. Aggregate Base Placement: Comply with recommendations of referenced geotechnical report and addendum.
   1. Place, moisture condition as necessary and compact aggregate base to 95 percent relative compaction per geotechnical engineer's requirements.
   2. Field test compacted aggregate base according to ASTM D1557.

B. Finish Grading: Performed grading under control of precision laser-controls.
   1. Grade surface contour, after final grading and compaction, shall be as indicated on the Drawings but not less than a crown of 0.5 percent originating at field centerline graded to field sides, with additional shaping of field end areas (outside field play surface on both field ends) to dress field contour to nominal curbing and nailer elevations.
   2. Finished surface of substrate shall have grades as indicated on the Drawings, to within tolerance of +0 to -1/4-inch. Demonstrate compliance by performing survey with a minimum of 500 shots noted (10-foot grid). Submit results of survey for Project Record.
   3. Compacted and graded final surface shall meet installed nailer top surface height within a 1/8-inch tolerance with no contour deviations allowed.
   4. Finished grade of aggregate base after final grading and compaction shall vary no more than ¼-inch in 10 feet.
   5. Installed drainage properties shall exceed 5-inches/hour (12.5 cm/hr) of vertical water passage. Performance shall be demonstrated utilizing acceptable compacted material test procedure, conducted by Testing Laboratory.
   6. Verify that all sub-base leveling is complete prior to installation.
   7. Installer shall examine the surface to receive the synthetic turf and accept the sub-base planarity in writing prior to the beginning of installation.
      a. Acceptance is dependent upon the Owner's test results indicating compaction and planarity are in compliance with manufacturer's specifications.
      b. The surface shall be accepted by Installer as "clean" as installation commences and shall be maintained in that condition throughout the process.
   8. Compaction of the aggregate base shall be 95%, in accordance with ASTM D1557 (Modified Proctor procedure); and the surface tolerance shall not exceed 0-1/4 inch over 10 feet and 0-½" from design grade.
   9. Correct conditions detrimental to timely and proper completion of Work.
   10. Do not proceed until unsatisfactory conditions are corrected.

3.04 INSTALLATION OF SYNTHETIC TURF SYSTEM

A. Installation of Synthetic Turf System: Comply with manufacturer's instructions and recommendations and the following.
   1. Notify manufacturer for review of the sub-base with adequate time to address any required modifications or adjustments.
   2. Surface to receive synthetic turf shall be inspected and certified in writing by manufacturer as suitable for proper installation of synthetic turf system.
   3. Loose lay synthetic turf across field, stretch and attach to perimeter edge detail. Turf shall be of sufficient length to permit full cross-field installation. No head or cross seams will be acceptable in playing field inside of football sidelines.
   4. Sew turf fabric seams using high-denier, UV-stabilized polyester thread. All seams shall be transverse to field direction (run perpendicularly across field). Seams shall be flat, tight, and

permanent with no separation or fraying.

5. At field perimeter and goal posts, secure turf fabric to nailers. Nailer at perimeter curb shall be located 1-1/2 inches (plus or minus 1/8 inch) below top surface of concrete curb. Attach nailer at 24- inches on center maximum using corrosion-resistant, powder-actuated driven masonry fasteners 36-inches on center or using 0.114-inch diameter, corrosion-resistant threaded anchors. Comply with requirements specified in Division 05 Section "Rough Hardware."
6. Mix and place infill materials in numerous thin lifts using special broadcasting equipment. Rake synthetic turf and brush properly as mixture is applied. Infill material shall be installed only when dry and to depth of approximately 1.75 inches in order to comply with initial Gmax standards.
7. Install at location(s) indicated, to comply with final shop drawings, manufacturers'/installer's instructions.
8. The Contractor shall strictly adhere to specified procedures. Any variance from these requirements shall be provided in writing, by the manufacturer's on-site representative, and submitted to the Architect and/or Owner, verifying that the changes do not in any way affect the Warranty. Infill materials shall be approved by the manufacturer and installed in accordance with the manufacturer's standard procedures.
9. Carpet rolls shall be installed directly over the properly prepared aggregate base. Extreme care shall be taken to avoid disturbing the aggregate base, both in regard to compaction and planarity.
    a. Repair and properly compact any disturbed areas of the aggregate base as recommended by manufacturer
10. Full width rolls shall be laid out across the field.
    a. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline.
    b. No cross seams will be allowed in the main playing area between the sidelines.
    c. Each roll shall be attached to the next roll utilizing standard state-of-the- art sewing procedures.
    d. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing surface.
11. Artificial turf panel seams shall be sewn along the selvedge edging flap of the turf roll. Seams secured by other means including gluing are unacceptable. Installation shall be 99% sewn.
    a. Minimum gluing will only be permitted to repair problem areas, corner completions, and to cut in any logos or inlaid lines as required by the specifications.
    b. Seams shall be flat, tight, and permanent with no separation or fraying.
    c. In the case of all lines and logos, turf carpet/field fibers must be sheared to the backing (do not cut the backing) and adhered using hot melt adhesives.
12. Infill Materials:
    a. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied. The infill material shall be installed to a depth determined by the manufacturer.
    b. Three-layered infill shall be installed in a systematic order.
    c. Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill installation consists of a base layer of sand followed by a homogenous mixture of the sand and the cryogenically processed rubber. A final application of specifically sized cryogenically processed rubber completes the system. The Infill shall be installed to the depth of 1 3/4". Infill density shall consist of no more than 6.2 pounds of sand and at least 2.2 pounds of rubber per square foot. The Infill shall be placed so that there is a void of ¾" to the top of the fibers.
13. Non-tufted or inlaid lines and markings shall be painted in accordance with turf and paint manufacturers' recommendations. Number of applications will be dependent upon

installation and field conditions.

14. Synthetic turf shall be attached to the perimeter edge detail in accordance with the manufacturer's standard procedures.
15. Upon completion of installation, the finished field shall be inspected by the installation crew and an installation supervisor.

B. Preparation
1. Prior to the beginning of installation, inspect the sub-base for tolerance to grade.
2. Sub-base acceptance shall be subject to receipt of test results (by others) for compaction and planarity that sub-base is in compliance with manufacturer's specifications and recommendations.
3. Dimensions of the field and locations for markings shall be measured by a registered surveyor to verify conformity to the specifications and applicable standards. A record of the finished field as-built measurements shall be made.
4. Installed sub-base shall be tested for porosity prior to the installation of the monofilament turf. A sub base that drains poorly is an unacceptable substrate

C. Installation - General
1. The installation shall be performed in full compliance with approved Shop Drawings.
2. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, topdressing or brushing operations.
3. The designated Supervisory personnel on the project must be certified, in writing by the turf manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

D. Field Markings: Provide football, flag football, and soccer field markings.
1. Provide "tufted-in" markings as indicated on the Drawings.
2. Provide other football, flag fo field markings by "inlaid" fabric, as indicated on the Drawings and according to reviewed shop drawings.
   a. Painting markings shall be used only where accepted by Architect.
   b. Color to be selected from manufactuerers standard or custom color palette.
3. Designs, markings, layouts, and materials shall conform to all currently applicable National Collegiate Athletic Association rules, NFHS rules, and/or other rules or standards that may apply to this type of synthetic grass installation. Designs, markings and layouts shall first be approved by the Architect or Owner in the form of final shop drawings. All markings will be in full compliance with final shop drawings.

3.05 CLEANING AND PROTECTION

A. Cleaning: Remove excess materials and clean synthetic turf of soiling and debris. Deliver all usable remnants to Owner.

B. Adjustments: Remove and replace damaged components and components that cannot be acceptably cleaned.

C. Protection: Prohibit construction traffic and storage of materials on completed synthetic turf. Provide temporary barriers and signage to prevent usage of field under Contract closeout.

END OF SECTION 321813.00 321813

SECTION 321814.20
PERMEABLE BASE SYSTEM - SOUTHERN CA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Permeable base aggregates for use under synthetic turf systems.

B. Drain rock aggregates and permeable base system components.

1.02 RELATED REQUIREMENTS

A. Section 321123 - Aggregate Base Courses.

B. Section 312200 - Grading.

C. Section 312316.13 - Trenching: Compacted fill over utility trenches under base course.

D. Section 312323 - Fill: Compacted fill under base course.

E. Section 321216 - Asphalt Paving: Finish and binder asphalt courses.

F. Section 321313 - Concrete Paving: Finish concrete surface course.

G. Section 330513 - Manholes and Structures: Manholes including frames.

H. Section 334100 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil–Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).

B. 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 .

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2019.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)); 2012 (Reapproved 2021).

F. ASTM D2166/D2166M - Standard Test Method for Unconfined Compressive Strength of Cohesive Soil; 2016.

G. ASTM D2434 - Standard Test Methods for Measurement of Hydraulic Conductivity of Coarse-Grained Soils; 2022.

H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017, with Editorial Revision (2020).

I. ASTM D2844 - Standard Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils; 2018.

J. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

K. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2022.

L. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2023.

M. ASTM E2583 - Standard Test Method for Measuring Deflections with a Light Weight Deflectometer (LWD); 2020.

N. ASTM F2898 - Standard Test Method for Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-confined Area Flood Test Method; 2011 (Reapproved 2019).

O. CT 227 - Standard Test Method for Cleanness of Coarse Aggregate; 2012.

P. CTM 217 - Standard Test Method for Sand Equivalency; 2011.

Q. CTM 229 - Standard Test Method for Durability Index; 2011.

R. GTM-7 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index; 2015.

S. Standard Specifications for Public Works Construction (Greenbook); current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal requirements.

B. Existing Installations: Submit a list of synthetic turf permeable base system installations previously installed by the Contractor. Include the name of each project's Owner representative and telephone number.

C. Product Data:
   1. Aggregate: Manufacturer's contact information, source location, qualification data, and manufacture's testing reports for gradation and material composition.
   2. Drainage Component: Manufacturer's descriptive product data for geotextile fabric, liners, subdrain piping, and drainage system components for use under synthetic turf fields.

D. Samples: Submit in a one-quart heavy duty plastic bag a sample of each aggregate to be used under synthetic turf fields. Clearly label material information on bag.

E. Conformance Surveys: Submit conformance documents from a California Licensed Surveyor of the compacted and finished subgrade and compacted and finished permeable base surface. Documents must show conformance to the design grades as indicated on the Drawings. Conformance Survey shall demonstrate compliance with spot elevations taken a maximum 25 foot grid and 10 foot spacing on perimeter curbs/walls/edge of paving. Submit results of survey for Project Record with Surveyor's certification stamped and signed.
   1. Finished subgrade under synthetic turf shall have a maximum deviation to 0.04 feet from design grade.
   2. Finished synthetic turf permeable base surface, perimeter curbs/walls/edge of paving shall have a maximum deviation of 0.02 feet.

F. Project Record Drawings: Accurately record location of all underground utilities, landscape irrigation system piping and control wiring, and changes in finish elevations and gradients which materially affect drainage. Comply with requirements specified in Section 01 7800 - Closeout Submittals.

G. Preconstruction Testing Reports: As specified in Part 1 of this Section.

H. Source Quality Control Reports: As specified in Part 2 of this Section.

I. Field Quality Control Reports: As specified in Part 3 of this Section.

1.05 QUALITY ASSURANCE

A. Mock-ups: See Section 01 4000 - Quality Requirements.
   1. Build mockups to verify selections made under sample submittals and to set quality standards for materials and execution.

2. Construct a synthetic turf permeable base mockup with minimum 30 foot by 30 foot area. Mockup shall be no less than 12 cubic yards of synthetic turf permeable base material. Mockup shall be a complete compacted subgrade with full depth of permeable base, geotextile fabrics and/or liner per the drawings.
3. Testing of Mock-Up: On-site and in place testing of aggregates shall be coordinated with the Owner' s testing agecy per the specified schedule. Include the following:
    a. Compaction: ASTM D1557, 89 - 92 percent relative compaction and soil moisture must comply with geotechnical requirements.
    b. Permeability: ASTM F2898, one test at a single center point of the mock-up. Permeability to not be less than 12 inches per hour when fully finished and compacted or per the design and project geotechnical recommendations, 1x per 20,000 sq ft. of material. 24 inches / hour minimum above perimeter trench 1x per 400 linear feet of storm drain trench.
    c. Deflection: ASTM E2583, 25 Mpa above storm drian trenches.
4. Prepare a secondary in-place Storm Drain Mock-up 30 feet long with #57 and #8 stone.
    a. Coordinate third-party deflection testing (25 Mpa minimum) and permeability testing (24 inches / hr minimum) in correlation with Landscape Architect and geotechnical engineer observation.
5. Contractor shall provide 10-day notice to the Owner and Architect for a request for observation of the mockup. Permeable base mockup shall be coordinated in construction schedule such that the Owner and Architect can observe, finished subgrade, installed liner / geotextiles, flat drains, and perimeter curbs.
6. Payment of specified testing of shall be the responsibility of the Owner. Retesting of material that has failed to meet the requirements of the specifications shall be at the Contractor’s expense.
7. Contractor shall replace, repair and refinish the mock-up as deemed necessary by the landscape architect until acceptable results are achieved.
8. Approved mock-ups may remain as part of the completed Work if undisturbed at time of Substantial Completion.

B. Preconstruction Testing: See Section 01 4000 - Quality Requirements.
1. Owner to engage a qualified testing agency to perform tests and inspections.
    a. Aggregate material will be considered defective if they do not pass tests and inspections.
    b. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
        1) Do not install product on the Project until passing test is achieved.
    c. Testing and inspecting agency to prepare reports and deliver to Owner or Contractor.
    d. Submit preconstruction testing reports to Architect.
2. Tests:
    a. Coordinate / provide samples directly from the manufacturer' s source, minimum 5-gallon bucket of aggregate material or quantities as specified by testing agency. Preconstruction testing of aggregates shall include:
        1) Sieve Analysis: ASTM C136/C136M.
        2) Sand Equivalency: CTM 217, 75 minimum.
        3) Fine Aggregate: CTM 229, 40 minimum.
        4) Coarse Aggregate: CTM 229, 40 minimum.
        5) Plasticity: GTM-7, NP (non-plastic).
        6) Expansion Pressure: ASTM D2844, 75 minimum.
        7) Coarse Aggregate Cleanness: CT 227, 80 minimum.
        8) Permeability: ASTM F2898, 12 inches minimum across permeable base and 24 inches minimum above storm drain trenches.
        9) Deflection: ASTM E2583, 25 Mpa above storm drian trenches.

10) Compaction: ASTM D1557, 89 - 92 percent relative compaction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 6000 - Product Requirements.

B. Aggregate materials shall be transported in a manner to prevent material segregation of course and fine aggregate.

C. Aggregate material shall be transported in clean containers or trucks without other materials or products.

D. Prevent contamination at delivery.

E. Contractor to minimize disturbing the material and shall not move the product more then 50 feet from original delivery location to minimize segregation.

F. Material must be kept at the optimal moisture content outlined in the geotechnical report from delivery until final install to minimize segregation.

G. Protect stockpiles from erosion and deterioration of materials.

H. Stockpiles must be placed atop an impermeable surface that will not allow contamination from other soils or materials onsite.

1.07 WARRANTY

A. See Section 01 6000 - Product Requirements and Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's standard warranty for each product.

PART 2 PRODUCTS

2.01 MATERIALS

A. Synthetic Turf Permeable Aggregate Base: Permeable aggregate base rock consisting of clean, virgin, well-graded, crushed stone, free of shale, clay, organic materials and debris.

1. Sand equivalent value of not less than 75.
2. Modified Caltrans Class 2 permeable base aggregate complying with testing requirements for permeable aggregated material under synthetic turf, the requirements of the synthetic turf manufacturer and the percentage of composition by weight of Caltrans Standard Specifications Class 2 permeable aggregate gradation as shown:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	90 - 100
1/2 inch	50 - 90
3/8 inch	35 - 70
No. 4	25 - 40
No. 8	18 - 30
No. 30	7 - 15
No. 50	0 - 7
No. 100	0 - 5
No. 200	0 - 2

B. Subdrain Fill ASTM #57 Drain Rock: 3/4 inch crushed, angular, washed aggregate drain rock for encasing perforated drainage piping consisting of clean, virgin, well-graded, crushed stone, free of shale, clay, organic materials, and debris.
   1. Comply with the testing requirements of aggregate material under synthetic turf and gradation as shown:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	80 - 100
1/2 inch	10 - 20
3/8 inch	0 - 10
No. 4	0 - 7
No. 8	0 - 5
No. 30	0 - 3
No. 200	0 - 1

C. Subdrain Leveling Course ASTM #8 Chip Stone: 3/8 inch virgin crushed, angular, washed chip stone aggregate rock for leveling above the gravel subdrain consisting of clean, virgin, well-graded, crushed stone, free of shale, clay, organic materials, and debris.
   1. Comply with testing requirements of aggregate material under synthetic turf and gradation as shown:

Sieve Size	Percent Passing
3/4 inch	100
3/8 inch	85 - 100
No. 4	10 - 30
No. 8	0 - 10
No. 30	0 - 5
No. 40	0 - 4
No. 200	0 - 1

D. Geotextile Fabrics:
   1. Non-woven Permeable Fabric: Mirafi 140N Non-woven polypropylene fabric manufactured by TenCate USA, Phone: +1-805-482-1722.
      a. Drainage performance of 130 gallons per minute per square-foot minimum.
   2. Non-Permeable Membrane Fabric: TITAN 30HD RGA.
      a. 30mil HDPE textured geomembrane woven reinforced impermeable fabric liner manufactured by titan environmental containment, Phone: 1-866-327-1957 | Email: info@titanenviro.com.
   3. All seams are to be heat welded / thermally fused with 3 foot minimum overlap.
      a. All utility penetrations and puncture repairs shall be watertight and sealed with exterior grade waterproof and watertight flexible caulking, DAP Alex Ultra, or equal.

E. Subdrain Piping:
   1. Subdrain Piping: Dual wall HDPE solid storm and perforated pipe manufactured by Advanced Drainage Systems, Inc. (ADS), Phone: +1-800-821-6710.

2. Perforated Flat Drains: AdvanEDGE 1-inch by 12-inch HDPE flat drain system with filter fabric manufactured by Advanced Drainage Systems, Inc. (ADS) Phone: +1-800-821-6710.
3. Fittings: Factory-manufactured couplings, wyes, caps and outlets to suit piping and project conditions.
4. Flat Drain Tape: Manufacturer recommended fitting and joint tape to secure flat drain fittings / pipe as needed.

F. Herbicide:
1. Phydura Natural Weed Killer from Soil Tech. Phone: +1-800-221-7645.
2. Apply to subgrade and base per manufacturer recommendations and all local, state and federal regulations.

PART 3 EXECUTION

3.01 EXAMINATION

A. See Section 01 7000 - Execution and Closeout Requirements.

B. Verify that survey bench marks and intended elevations for the work are as indicated.

C. Furnish subgrade conformance survey of compacted subgrade.

D. Verify subgrade has been inspected, grades and elevations are correct, and surface is dry and stable.

E. Comply with Section 312200 - Grading, and recommendations of project geotechnical report.

F. Preinstallation Testing: The following testing shall be performed on stockpiled aggregate material to be used under synthetic turf as delivered per 1,000 tons of material prior to use: Contractor shall supply a minimum 5-gallon bucket of aggregate material or quantities as specified by the testing Agency. Once passing test results from the Owner' s testing agency are reported the material can be installed:
1. Sieve Analysis: ASTM C136/C136M.
   a. Sieve shall match the requirements set forth in part 2 products section of this specification for custom modified permeable base and Storm drain trench ASTM #57 Stone and ASTM #8 stone.
2. Sand Equivalency: CTM 217, 75 minimum for the mixed custom modified permeable base stone.
3. Coarse Aggregate Cleanness: CT 227, 80 minimum for each sieve size of modified permeable base stone.

3.02 PREPARATION

A. See Section 01 7000 - Execution and Closeout Requirements.

B. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

C. Do not place geotextiles or aggregate on soft, muddy, or frozen surfaces.

D. Do not apply permeable base or perform grading operations in rain or inclement weather.

E. Verify that all subgrade leveling is complete and compacted and the subgrade Conformance Survey has been approved by the Architect prior to installation of geotextiles and base.

3.03 INSTALLATION

A. See Section 01 7000 - Execution and Closeout Requirements.

B. Perform grading under control of precision laser-controls.

C. Spread aggregate over prepared substrate to a total compacted thickness as indicated on Drawings.

D. Place aggregate in maximum 4-inch layers and compact with smooth roller equipment to specified density. Do not use vibratory action on roller.

E. Level and contour surfaces to elevations and grades indicated on Drawings.

F. Moisture condition and compact permeable aggregate base in accordance with ASTM D1557 Modified Proctor procedure. Refer to drawings and project geotechnical recommendations for compaction requirements. Permeable base relative compaction and moisture conditioning shall be within the provided range of the Geotechnical engineer's report.

G. Use mechanical tamping equipment in areas inaccessible to roller compaction equipment.

H. Do not overwork material.

I. Apply broad spectrum herbicide to finished base per manufacturer requirements.

3.04 TOLERANCES

A. Gradient: Finished surface gradients and contours after final grading and compaction, shall be as indicated on the Drawings but not less than 0.5 percent.

B. Compacted Permeable Base Thickness: Within 0.02 feet.

C. Finished Surface Design Elevation: Within 1/4 inch over 10 feet.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Owner to engage a qualified testing agency to perform tests and inspections.
   1. Material and assemblies will be considered defective if they do not pass tests and inspections.
   2. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
   3. All material not meeting the specifications shall be removed from the site at the Contractor’s expense.
   4. Testing and inspecting agency to prepare reports and deliver to Owner or Contractor.
   5. Submit field quality control reports to Architect.

C. Tests:
   1. See Section 321123 - Aggregate Base Courses, for compaction testing of permeable aggregate base.
   2. Compaction: ASTM D1557, 89 - 92 percent relative compaction and soil moisture must comply with geotechnical requirements, provide test results overlayed on plan location set on a 25’-0” grid.
   3. Permeability: ASTM F2898, one test per 15,000 square feet of material in locations approved by the Architect. Permeability to not be less than 12 inches per hour when fully finished and compacted or per the design and project geotechnical recommendations, 1x per 20,000 sq Ft. of material. 24 inches / hour minimum above perimeter trench 1x per 400 linear feet of storm drain trench.
   4. Deflection: ASTM E2583, 25 Mpa above storm drian trenches.
   5. Permeability Testing: Of compacted and finished perneable base assembly.
      a. Perform in accordance with ASTM D2434.
   6. Contractor shall replace, repair and refinish finished base and aggregate materials from all on-site testing locations.

D. Observations:
   1. Permeable Base Planarity: To be performed by Architect and synthetic turf installer.

a. Contractor to perform preliminary planarity check with 10 foot straight edge and string line verification every 5 feet across the width of the field. Confirm planarity prior to calling for observation by architect and acceptance by synthetic turf installer.
b. The surface planarity may not deviate more than 0.02 feet in any direction when pulling a string line or using a 10 foot straight edge.
c. Give 10-day notice to the Architect and synthetic turf installer for observation of the finished synthetic turf permeable base.
d. Final planarity and acceptance by the synthetic turf installer shall be determined using a string line method.
    1) Make all necessary adjustments to accommodate the requirements of the synthetic turf installer for clean base planarity and compaction.
    2) Provide necessary staging are, site access, and scheduling of operations for synthetic turf installation to meet the construction schedule.

3.06 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

SECTION 321823
SYNTHETIC RUNNING TRACK SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Synthetic running track surfaces.

B. Line markings.

C. Track Asphaltic Concrete Base Course (Two-Layer System)

D. Jump Pit Sand

1.02 RELATED REQUIREMENTS

A. Section 32 12 16 - Asphalt Paving.

B. Section 32 13 13 - Concrete Paving.

C. Section 31 22 00 - Grading: Excavation, backfill and compaction required for installation of synthetic running track surfacing.

D. Section 11 68 33 - Track and Field Products

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

C. ASTM D3389 - Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader); 2021.

D. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

E. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

F. ASTM F925 - Standard Test Method for Resistance to Chemicals of Resilient Flooring; 2013 (Reapproved 2020).

G. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

I. ASTM F3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2018.

J. DIN 18035-6 - Sports Ground - Part 6: Synthetic Surfaces; 2021.

K. IAAF/NCAA - Performance Specification for Synthetic-Surfaced Athletics Tracks (Outdoor) 1999.

L. DIN 4102-1 - Fire Behavior of Building Materials and Building Components - Part 1: Building materials; concepts, requirements and tests 1998.

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's product data including standard specifications, installation guidelines and maintenance instructions.
   1. Submit documentation that synthetic running track surfacing material is free of toxic or hazardous substances that exceed the limits set forth by the U.S. Environmental Protection Agency.

C. Shop Drawings: Show location and color of lane lines, start lines, finish lines, and related markings for Owner to review a minimum of 4 weeks prior to application.

D. Samples: Three, 12 inch by 12 inch samples of the full-depth system in the color(s) indicated on the contract documents.

E. Certifications:
   1. Submit installer's certification that the installer has reviewed the asphalt or concrete base drawings and specifications and accepts the asphalt or concrete base will be suitable if constructed as indicated and specified.
   2. Submit installer's certification that in-place concrete or asphalt substrate is acceptable as installed.
   3. Submit certification from registered engineer or land surveyor that synthetic running track surface layout and dimensions are as shown on drawings.

F. Test Reports: Reports of field quality control testing.

G. Manufacturer's Instructions: Submit copies of manufacturer's written installation instructions and other recommendations

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Maintenance Data.

K. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

L. Conformance Surveys: Stamped and signed surveys provided by surveyors licensed in the State of California.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company that has produced surfacing materials for not less than ten years with not less than five similar projects that have been in successful use for more than five years.

B. Installer Qualifications: Minimum five years experience in successful installation of surfacing systems of type specified herein.
   1. Submit manufacturer's certification that installer is qualified to install the products specified.
   2. Submit installer's certification that installer is a member of American Sports Builders Association (ASBA).
   3. Submit installer's certification that installer employs at least one ASBA “Certified Track Builder” (CTB) on installation team for project.

1.07 DELIVERY STORAGE AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store in weathertight location and protect from damage during delivery, storage and handling.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a one year period after date of Substantial Completion.

C. Provide ten year manufacturer warranty for synthetic running track surface system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Synthetic Running Track Surfacing:
   1. Beynon Sports, A Tarkett Company.
   2. Provided by District via CMAS agreement
      a. Product: BSS 300 13mm Poured in place encapsulated rubber track system
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Asphaltic Concrete
   1. Vulcan materials, Gail Materials, Reliance Materials or Equal.

C. Jump Pit Sand
   1. Vulcan materials, Gail Materials, Reliance Materials or Equal.

2.02 SUBSTRATE

A. Asphaltic Concrete Substrate: As indicated on the Drawings and as specified in this section. Materials shall be compatible with synthetic running track surfacing.

B. Place and compact subgrade with suitable materials as required by the Geotechnical Engineers report and as directed in the field by the Geotechnical Engineer and Inspector, to the subgrade elevations shown on the grading plans.

C. Coordinate with the Geotechnical Engineer when cement / lime treatment of the subgrade occurs for heavy equipment use, access and cure time.

D. Refer to aggregate base per 32 11 23, over-excavate place and compact a minimum of 9 inches at 95% relative compaction, or per geotechnical engineer’s report to elevations of subgrade.

E. A.C. Binder (Base) Course: 1.5” Minimum thickness, graded to elevations and checked for accuracy to within the tolerances specified, prime asphalt for application on compacted aggregate base per MC-1.
   1. Gradation of composite aggregate for the Asphalt Binder (Base) Course shall conform to the following sieve sizes per Greenbook Section 203 C2:

Seive	Total % Passing
1"	100
3/4"	90-100
3/8"	60-75
#4	28-42
#10	15-25
#30	5-15
#100	0-5

F. A.C. Top Coat: applied immediately after the placement of the Asphalt base Coat. Primer for application on asphalt surfaces (base course) shall be RC-1.
   1. A.C. Top Coat: Minimum of 1.5” Minimum thickness, graded to elevations and checked for accuracy within the tolerances. Gradation of composite aggregate for the Asphalt Top Coat shall conform to the following sieve sizes per Greenbook Section 203 C2:

Seive	Total % Passing
1/2"	100
3/8"	90-100
#4	60-90
#8	35-65
#30	20-30
#50	6-25
#100	5-15
#200	2-10

2.03 SYNTHETIC RUNNING TRACK SURFACING

A. Synthetic Running Track Surfacing: cast-in-place, durable, spike-resistant, all-weather track surface consisting of resilient polyurethane bound rubber base mat and impervious, colored, solid pour coating with colored EPDM rubber granule top:
   1. Base layer: Mixture of uniformly graded base mat rubber granules bound with a specially formulated, single-component polyurethane binder applied to a pervious or impervious base by means of a mechanically operated screed.
   2. Base coating: Specially formulated polyurethane to create an impervious mat.
   3. Flood coating: Specially formulated pigmented polyurethane flood coat into which colored EPDM rubber granules are broadcast prior to curing.
   4. Wear layer: Multiple spray-applied structural mix of uniformly-graded broadcast rubber (EPDM rubber granules) mixed with specially-formulated, highly-pigmented polyurethane, with painted striping and markings.

2.04 RUBBER

A. Base mat rubber: specifically graded elastomeric styrene butadiene rubber (SBR) granules with a controlled gradation between 0.04 inch and 0.12 inch:
   1. Rubber shall have minimum hardness of 55 durometer (Shore A).
   2. Dust and rubber particulate smaller than a No. 200 sieve size shall not exceed 4 percent of total rubber.
   3. Rubber shall be dried to less than 2.5 percent moisture content and packaged in sealed bags.
   4. Specific gravity shall be 1.15 to 1.40.
   5. Base mat rubber shall be black color.

B. Wearing course (broadcast) rubber: synthetic colored ethylene propylene diene (EPDM) rubber granules. Final gradation shall be 0.04 inch to 0.16 inch.:
   1. Rubber shall be dried to less than 1.0 percent moisture content and packaged in sealed bags.
   2. Specific gravity shall be 1.40 to 1.60.
   3. Rubber shall have minimum hardness of 55 durometer (Shore A).
   4. Color shall be gray w/ dark green exchange zones.

C. Color Course Rubber: Ethylene propylene diene monomer (EPDM) synthetic rubber granules, same color as polyurethane structural spray binder:
   1. Gradation shall be between 0.02 inch and 0.16 inch, with percentages as recommended by track surfacing manufacturer.

2. Specific gravity shall be 1.55, ±0.03.
3. Rubber shall be dried to less than 1.0 percent moisture content and packaged in sealed bags.
4. Rubber granules shall be cryogenically ground.
5. Color shall be as indicated on the Drawings or, if not indicated, as selected by Architect.
6. No SBR shall be permitted in color course.

D. Color Course (Structural Spray) Rubber:
1. Gradation shall be between 0.02 inch and 0.12 inch, with percentages as recommended by track surfacing manufacturer.
2. Specific gravity shall be 1.55, ±0.03.
3. Rubber shall be dried to less than 1.0 percent moisture content and packaged in sealed bags.
4. Color shall be as indicated on the Drawings or, if not indicated, as selected by Architect.
5. No SBR shall be permitted in color course.

2.05 BINDER

A. Binder: base mat binding agent, single-component, MDI based, 100 percent solids, moisture cure polyurethane binder.
1. Polyurethane binder shall comply with regional air quality regulations for VOC emissions.
2. Polyurethane base mat binder shall be compatible with SBR and EPDM.
3. Base mat binder shall have the following minimum characteristics:
a. Density: 1.08 + 0.03 g/cm3 @ 20 deg. C.
b. Viscosity: 3,700 + 700 mPa.s. @ 20 deg. C.
c. Flash Point: ???150 deg. C.
d. Elongation: ??? 450 percent.
4. Binding agent shall be compatible with asphalt and with SBR, EPDM and Nike Grind granules.
5. Binding agent shall comply with the following minimum standards:
a. Polymer type: Polyurethane Base Mat Binder.
b. Color: Clear.
c. Density: 1.08 ± 0.03 g/cm3 at 68 degrees Fahrenheit.
d. Viscosity: 3,700 ± 700 mPa.s. at 68 degrees Fahrenheit.
e. Flash point: ??? 302 degrees Fahrenheit.
f. Elongation: ??? 450 percent.

B. Base Mat Sealer: solvent-free, two-component, thixotopic, polyurethane based filler compound:
1. Sealer shall comply with regional air quality regulations for VOC emissions.
2. Base mat sealer shall be compatible with SBR and EPDM.
3. Base mat binder shall have the following minimum characteristics:
a. Polymer Type: Polyurethane Base Mat Sealer.
b. Mix Ratio (A: B): 100: 27 (by weight).
c. Density (mixture): Approximately 1.40 g/cm3 @ 20 deg. C.
d. Viscosity: Thixotropic.
e. Tensile Strength: 3.5 + 0.5 N/mn2 (DIN 53504).
f. Durometer: 70 + (Shore A).
4. Polyurethane sealer shall comply with Federal, State and regional air quality regulations for volatile organic compounds (VOCs), including South Coast Air Quality Management District.

C. Flood Coat Binder: highly-pigmented, two-component, solvent-free, self-leveling, elastic polyurethane coating:
1. Sealer shall comply with regional air quality regulations for VOC emissions.
2. Base mat sealer shall be compatible with specified EPDM.
3. Color shall match EPDM wearing course rubber.

4. Flood coat binder shall have the following minimum characteristics:
   a. Polymer Type: Polyurethane.
   b. Mix Ratio (A: B): 100: 65 (by weight).
   c. Density (mixture) 1.26 g/cm3 @ 20 deg. C.
   d. Viscosity (mixture): 3,300 + 500 mPa.s. @ 20 deg. C.
   e. Durometer: 52 + 3 (Shore A).
   f. Tensile Strength: Approximately 2.7 N/mn2 (DIN 53504/S2).
   g. Elongation: Approximately 150 percent.

D. Structural Spray Binder: Highly-pigmented, MOl-based, 100 percent solids, moisture cure polyurethane coatings:
   1. Structural spray binder shall comply with Federal, State and regional air quality regulations for volatile organic compounds (VOCs), including South Coast Air Quality Management District.
   2. Color shall be same as rubber, as indicated on the Drawings.
   3. Structural spray binder shall comply with the following minimum properties:
      a. Polymer type: Polyurethane Structural Spray Coat.
      b. Density: 1.05 ± 0.03 g/CM3 @ 68 degrees Fahrenheit.
      c. Viscosity: 900 mPa.s.
      d. Isocyanurate content: 5.5 ± 0.3 percent.
      e. Tensile strength: 5.0 ± 0.5 N/mn2 (DIN 53504).

E. Running Track Performance

Performance Criteria	Test Method	Requirement	Result
Elongation at Break	ASTM D412	≥100%	≥200%
Tensile strength	ASTM D412	≥75PSI	≥135PSI
Hardness, Shore A wear layer	ASTM D2240	55 ±5	50
Hardness, Shore A wear layer	ASTM D2240	55 ±5	40
Abrasion resitance (H18 wheel, 500g, 1,000 cycles)	ASTM D3389	≤ 2.0g	≤ 1.2g
critical Radiant Flux	ASTM E648	≥ 0.1 w/cm2	Compliant
Thickness	ASTM F387	13.5mm (+/-0.01 inch)	13.5mm (+/- 0.3 mm)
Chemical Resitance	ASTM F925	≤ Slight Change	Compliant
Heat Stability	ASTM F1514	≤80 ΔE	Compliant
Synthetic surfaced Running Tracks	ASTM F2157	Class A	Class A
Elongation at break	EN 12230	≥40%	≥115%
tensile strength	EN 12230	≥0.4MPa	≥0.75MPa
slip/skid restance (dry)	EN 13036-4	80-110	83
slip/skid resitance (wet)	EN 13036-4 IAAF	≥47	61
shock absorption	EN 14808 IAAF	35-50%	39%
vertical deformation	EN 14809 IAAF	0.6-2.5mm	compliant

spike resistance	EN 14810	ΔEb% ≤20	compliant
track and runway testing specifications	IAAF	compliant	Compliant
certified track surfacing product	IAAF	compliant	IAAF Certification
indoor air quality: French Decreee No. 2011-321	ISO 16000-9	-	Compliant (class A+)
Indoor Air Quality: Greenguard Gold	UL 2821/UL 2818	-	Compliant
Indoor Air Quality: Greenguard Certification	UL 2821/UL 2818	-	Compliant
Indoor Air Quality: CA Section 01350	CDPH: V1.2-017	-	Compliant

2.06 ACCESSORIES

A. Portland cement based patching or leveling compound to be recommended/approved by Manufact urer

B. Protective Mats: non-woven material, heat-welded. Protective mats shall be warranted by manufacturer for not less than 5 years:
   1. Mat sizes:
      a. 5 each, 20'-0" by 33'-6".
      b. 1 each, 20'-0" by 36'-6".
      c. 1 each, 72'-0" by 33'-6".
   2. Deliver mats to District as directed by District.

C. Marking and line paint:
   1. Paint shall be formulated to be compatible with synthetic track surface materials.
   2. Colors shall be as indicated on the drawings and the appropriate governing body: NFHS, ASBA, C.I.F., and IAAF.

D. Long / Triple Jump Sand
   1. Appearance: Sand shall be a washed, white pigmented, fluffy, non-crusting sand containing no organic material.
   2. Particle Shape: sand shall have high sphericity characteristics and be well rounded. Angular particles will not be accepted.
   3. Uniformity coefficient: the uniformity coefficient (cu) shall be between 2.0 – 5.0 using the modified penetrometer method.
   4. Crusting: Calcareous sands that contain calcium carbonate will not be accepted. A passing acid reaction test is required for Calcareous sand to be submitted. Silica sands will not need supporting acid reaction test results.
   5. Color: based on the Munsell color chart the sand shall be 'White Sand Dunes'.
   6. Particle size shall meet the following Sieve:

Particle	Diameter (MM)	Seive	% Retained by Weight
Very Coarse Sand	1.0 - 2.0	# 18	15% Max
Coarse Sand	0.5 - 1.0	# 35	78-100%
Medium Sand	0.25 - 0.5	# 80	78-100%

Fine Sand	0.1 - 0.25	# 140	78-100%
Very fine Sand	0.05 - 0.10	# 270	5% max
Silt + Clay	0.05	Pan	3% Max

7. No particles larger than 2.0mm are acceptable per NCAA, IAAF and CIF competition regulations.
8. Available from: Gail Materials, Reliance Materials, Corona Materials or equal.

E. For other track and field items refer to 116833 Athletic Field Equipment.

2.07 MARKINGS

A. Track and Event Line Marking Paint: Polyurethane paint formulated for exterior service environments in striping applications in color as specified for line markings.
   1. All painting products are to be recommended/approved by Manufacturer.
   2. Thickness: 12 mils dry film thickness (DFT).
   3. Multiple coats to achieve thickness as required by paint manufacturer.
   4. Prime surface to achieve adhesion characteristics of paint.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Do not proceed until unsatisfactory conditions have been corrected.
   2. Substrate tolerances:
      a. Planarity: Not to exceed 1/4 inch in 10 feet, non-cumulative.
      b. Levelness: Not to exceed 0.1 percent in running direction.
      c. Concrete Curbs: Ensure top elevations of continuous concrete curbs are at constant elevation.

B. Flood Test: Flood substrate immediately after substrate is capable of supporting foot traffic. Allow to dry for 20 minutes.
   1. If any areas of ponded water (“birdbaths”) are visible at the end of the 20 minute drying time, correct areas of substrate that allow water to pond.
   2. Obtain Architect's written approval of method of correction prior to proceeding with corrective work.
   3. Cold tar patching, skim-coat patching and sand-mix patching are not acceptable methods of correction.

C. Meet Manufacturer's Requirements:
   1. Prior to Resilient Track Surfacing, Flooring Contractor must ensure that the substrate is read y to receive resilient flooring and that it has been effectively prepared according to Manufacturer’s current substrate surface preparation guidelines. Refer to current version of ASTM F710 for additional information.
   2. Ensure that no concrete sealers or curing compounds have been applied to or mixed into the concrete.
   3. Installation of the Resilient Track Surfacing to be carried out no sooner than the specified curi ng time of the concrete (normal density concrete curing time is approximately 28 days for development of design strength, having a minimum 3500 psi or 3628 psi in compressive strength).

4. Ensure that concrete surface is free of any contaminant that could inhibit bond (paint, wax, d ust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.
5. Confirm concrete has a smooth finish, proper density and is highly compacted with a toleranc e of 1/8th of an inch in a 10-foot radius (0.13 inch in a 3.34 yard radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.
6. Concrete substrates must be free of any hydrostatic and/or moisture problems. Moisture and a lkalinity tests must be performed on all concrete substrates, under in-service conditions. For accurate test results, ensure that the HVAC unit has been operational for 7 days and that the ambient conditions are stable, prior to performing any moisture and alkalinity tests. The concrete's surface pH must be between 7 and 10. Relative humidity of the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with the current version of ASTM F1869 (anhydrous calcium chloride). Where tolerances are exceeded and a moisture mitigation system will be specified, refer to ASTM F3010. Moisture and alkalinity test results must be recorded and copies must be kept for a minimum of 3 years or for the duration of the warranty period.
7. Ensure room and substrate temperatures are maintained prior to moisture testing and Resili ent Track Surfacing installation, during the entire installation, as well as a minimum of 48 hours after the Resilient Track Surfacing has been completely installed. Recommended ambient temperature range is between 65oF and 86oF (18oC and 30oC) and recommended ambient humidity range is between 35% and 55%. Ambient temperature must always remain a minimum of 5°F (3°C) above dew point for the duration of the Resilient Track Surfacing installation and for 72 hours after the completed installation
8. Installer to perform bond tests with specified products to confirm suitability and strong adhe sion to the substrate, per ASTM F3311 (mat bond evaluation). Special attention should be paid to any area where a contaminant was removed, in order to confirm removal effectiveness. Refer to Manufacturer's current printed substrate preparation manual for additional notes on bond tests.
9. Installation of Resilient Track Surfacing will not commence until the building is enclosed and a ll other trades have completed their work. It is the General Contractor or Construction Manager's responsibility to ensure that a secure and clean working area is maintained before, during and after the installation of the Resilient Track Surfacing.

3.02 PREPARATION

A. Protection: Protect surfaces adjacent to track surfacing operations from polyurethane liquids.

B. Surface Preparation: Verify substrate is fully cured and free from excess surface oils and chemicals that would impair track surface installation.

C. Ensure that asphalt compaction tests indicate compaction of 95 percent or greater. Check asphalt with 10 foot straightedge in all directions. Repair areas not in conformance or replace with new materials, recompact, and recheck surfaces.

3.03 INSTALLATION

A. General:
   1. Comply with manufacturer's recommendations.
   2. Prime areas to be surfaced.
   3. Make substrate surface repairs and minor planarity corrections with repair compound.

4. Install track surface as specified to achieve track surface performance and physical dimensions within tolerances.

3.04 INSTALLATION OF SYNTHETIC TRACK SURFACE (BY OTHERS) CMAS

3.05 ASPHALTIC CONCRETE

A. Asphaltic Concrete Substrate: Prepare subgrade, place and compact base and place and finish asphaltic concrete as specified below and according to synthetic running track surfacing manufacturer's requirements and to depth as indicated on the plans and as required by the Geotechnical Engineer's report (vehicular loading for fire apparatus):
   1. Asphaltic concrete substrate shall have cured minimum of 14 to 21 days, depending upon weather conditions, and prior to starting placement of synthetic running track surfacing.
   2. Verify by survey that elevations of asphaltic concrete surface are in compliance with required gradient tolerances specified in referenced standards and that positive drainage of surface is provided.

B. Subgrade:
   1. The subgrade shall be rolled and compacted by a roller per geotechnical engineer's report; if no rate is provided, compaction shall be to minimum density at 95% as determined by the Modified Proctor Test (AASHTO T99).
   2. Subgrade elevation tolerances shall be within plus or minus ¾" of specified elevations.

C. Aggregate Base:
   1. The aggregate base shall be placed and compacted to the thicknesses and compaction rates per the geotechnical engineer's report and design plans.
   2. Elevation tolerances of the crushed aggregate base course finished surface shall comply within plus or minus 5mm (¼") of design elevations.

D. Hot Mix Asphalt:
   1. Keep hot mix asphalt clean during hauling and cover during transit to retain heat, prevent segregation or forming of crust on surface of the mix during transport.
   2. Spread hot mix asphalt with self-propelled machine spreader having a floating screed assembly controlling the elevation at strike-off; the use of road graders or towed spreaders will not be allowed. Utilize automatic screed controls to adjust automatically, resulting in a uniform mat of desired thickness, grade and shape.
   3. Compact hot mix asphalt with roller while mix is at or above 185 degrees Fahrenheit, to 97% or more of the density (ASTM F2726) obtained on a retained job mix specimen by the seventy-five blow Marshall procedure (ASTM D1559), Marshall stability (ASTM D1559) shall be 750 lbs. or greater.
   4. Finished surface of pavement courses shall comply with the following tolerances itemized in following table:

Item	Charateristic	Tollerance
Top Coat	Level	+2mm / -2mm from design levels
	Thickness	+5mm / -0mm from design thickness
	Flatness	3mm maximum departure from a 3m straight edge in all directions
Base Course	Level	+4mm / -4mm from design levels

	Thickness	+5mm / -0mm from design thickness
	Flatness	4mm maximum departure from a 3m straight edge in all directions

5. Asphaltic concrete substrate shall have cured minimum of 14 to 21 days, depending upon weather conditions, and prior to starting placement of synthetic running track surfacing.
6. Verify by survey that elevations of asphaltic concrete surface are in compliance with required gradient tolerances specified in referenced standards and that positive drainage of surface is provided.
7. Conformance Survey: Contractor shall provide at no additional cost, conformance survey from a California Licensed Surveyor of in-place curbs, asphaltic concrete base and drainage appurtenances, for approval of Architect and Owner, submitted minimum 14 days prior to scheduling track surfacing application, Documents must show conformance to the design finished grades as indicated on the Drawings. Conformance Survey shall demonstrate compliance with spot elevations taken a maximum 25-foot grid and at all visible deviations in planarity; provide 10-foot spacing on perimeter curbs/drains/edge of paving. Submit results of survey for Project Record with Surveyor' s certification stamped and signed.
   a. Finished grade AC base course, curbs/drains/edge of paving shall have a maximum deviation design grade as shown in part 3.05-4. above.
8. Flood Test: Flood substrate immediately after substrate is capable of supporting foot traffic. Allow to dry for 20 minutes.
   a. If any areas of ponded water (“birdbaths”) are visible at the end of the twenty-minute drying time, correct areas of substrate that allow water to pond.
   b. Obtain Architect's written approval of method of correction prior to proceeding with corrective work.
   c. Cold tar patching, skim-coat patching and sand-mix patching are not acceptable methods of correction.
9. Remedial Work: Repair or replace asphaltic concrete substrate, as acceptable to District, to eliminate high spots, low spots and improper planarity. Remedial Work shall be performed with no change in Contract Time and Contract Sum. All work must comply with requirements of surfacing manufacturer.
10. Inspection of Asphaltic Concrete Substrate:
    a. Minimum of 7 days prior to starting placement of synthetic running track surfacing, authorized representative of synthetic running track surfacing manufacturer shall inspect asphaltic concrete substrate and determine that substrate complies with the following:
       1) Dimensional accuracy.
       2) Strength.
       3) Surface Preparation.
       4) Planarity.
11. Notify District and Architect in writing of unsatisfactory conditions. Do not begin application of synthetic running track surfacing until deficiencies in substrate have been corrected and are ready to receive surfacing.

3.06 TRACK AND EVENT LINE MARKING

A. Track and Event Line Markings, General: Comply with the requirements of the referenced IAAF / NCAA standards.

B. Provide IAAF / NCAA standard markings for the following track and field events:
   1. 100 m.

2. 200 m.
3. 400 m.
4. 800 m.
5. 1000 m.
6. 1500 m.
7. 1 mile.
8. 2000 m.
9. 3000 m.
10. 3000 m steeplechase.
11. 5000 m hurdles.
12. 100 m hurdles.
13. 110 m hurdles (men and women).
14. 4 by 100 m relay.
15. 4 by 200 m relay (completed in lanes).
16. 4 by 400 m relay.
17. 4 by 800 m relay.
18. 4 by 1500 m relay.
19. Other events defined by Owner.
20. NCAA events.
21. Field events; Pole Vault, Long / Triple Jump

3.07 TOLERANCES

A. Percent Granules: Variation of plus or minus 2 percent.

B. Slopes:
   1. Track Oval:
      a. Running Direction: 1.0 percent, maximum.
      b. Lateral Slope: 1.0 percent maximum.
   2. High Jump ("D" area): 1.0 percent maximum, downwards to the cross bar.
   3. Run Ups: Same as track oval unless located in the High Jump ("D") area.

3.08 FIELD QUALITY CONTROL

A. Tests: Perform thickness, hardness and deformation tests. Employ an Independent Testing Laboratory for the purpose. Submit reports.
   1. Conduct 60 thickness test spaced throughout the track surface.
   2. Conduct 5 hardness and deformation tests.

3.09 CLEANING

A. Leave surfacing in clean condition and free of surface defects.

B. Reapply and touch up paint striping once during the warranty period.

C. Clean and flush track slot drian and cleanouts after surfacing installation.

3.10 PROTECTION

A. Protect installed surfacing from damage during the balance of construction activity.

END OF SECTION 321823

SECTION 323113
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Posts, rails, and frames.

B. Wire fabric.

C. Manual gates with related hardware.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete anchorage for posts.

B. Section 32 13 13 - Concrete Paving: Topping Slab at footings

C. Section 337900 - Site Grounding.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a (Reapproved 2022).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

G. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2023.

H. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric; 2017 (Reapproved 2022).

I. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework; 2018 (Reapproved 2022).

J. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2018 (Reapproved 2022).

K. ASTM F1665 - Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used with Chain-Link Fence; 2008 (Reapproved 2022).

L. CLFMI CLF-PM0610 - Product Manual; 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

C. Shop Drawings: Indicate in plan layout and elevation, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

D. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation anchor bolt templates,.

E. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines _____.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Posts, Rails, and Frames:

B. Wire Fabric:

C. ASTM A392 zinc coated steel chain link fabric.

D. Conform to CLFMI CLF-PM0610.

E. Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 2,500 psi strength at 28 days, 3 inch slump; ____ inch nominal size aggregate.

2.02 COMPONENTS (MINIMUM SIZES UNLESS OTHERWISE INDICATED ON DRAWINGS)

A. Line Posts: 1.9 inch diameter.

B. Corner and Terminal Posts: 4.0 inch diameter.

C. Gate Posts: 4 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter for welded fabrication.

F. Fabric: 1-3/4 inch diamond mesh interwoven wire, 6 gage, 0.1920 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.

G. Tension Wire: 6 gage, 0.1920 inch thick steel, single strand.

H. Brace Band: Galvanized and beveled.

I. Tension Band: Galvanized and beveled.

J. Tension Flat Bar: 3/4 or 5/8 inch width galvanized steel.

K. Tie Wire: Aluminum alloy steel wire.

2.03 MANUAL GATES AND RELATED HARDWARE

A. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 96 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.

B. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 96 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

C. Ground fence in accordance with Section 337900.

2.04 **ACCESSORIES/HARDWARE**

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

C. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with **CBC Section 11B-404.**

D. The lever of lever actuated latches or locks for an accessible gate shall be curved with a return to within 1/2" of the (face of) gate to prevent catching on the clothing or persons. **California Referenced Standards code. T-24 part 12, Section 12-10-202, Item (F).**

E. Swing doors and gate surfaces within 10" of the finish floor or ground shall have a smooth surface on the push side extending the full width of th door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. **CBC Section 11B-404.2.10**

F. The clear opening width for a door shall be 32" minimum. For a swinging doors it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34" and 4" maximum projections into it between 34" and 80" above the finish floor or ground. Door closers and stops shall be permitted to be 78" minimum above the finish floor or ground. **CBC Section 11B-404.2.3**

G. Handles pulls, latches, locks, and other operable parts on accesisible doors shall comply with **CBC Section 11B-309.4** and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34" minimum and 44" maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usalbe from both sides. **CBC Section 11B-404.2.7**

H. The force for pushing or pulling open a door shall be as follows: **CBC Section 11B-404.2.9**
   1. Interior hinged doors, sliding or folding doors: **5 pounds(22.2N)** maxiumum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed **15 pounds (67N)**. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
   2. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds(22.2 N)maximum to comply with CBC Section 11B-309.4

I. Door closing speed shall be as follows: **CBC Section 11B-404.2.8**
   1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is **5** seconds min.
   2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is **1.5** seconds minimum.

J. Thresholds shall comply with **CBC Section 11B-404.2.5**

K. Floor stops shall not be located in the path of travel and 4" maximum from walls. **DSA Policy 99-08**.

L. Hardware (including panic hardware) shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met per **DSA Interpretation 10-08 DSA/AC (External), revised 4/28/09.** Such conditions must be clearly demonstrated and indicated in the specifications:
   1. Such hardware has a 'dogging' feature.
   2. It is dogged during the time the facility is open.
   3. Such 'dogging' operation is performed only by employees as their job function(non-public use).

M. Pair of doors: limit swing of one leaf to 90 degrees so that a clear floor space is provided beyond the arc of the swing for the wall-mounted tactile sign. **CBC Section 11B-703.4.2.1**

2.05 FINISHES

A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot.

B. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.

C. Accessories: Same finish as framing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Place fabric on outside of posts and rails.

C. Set intermediate posts plumb , in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

D. Line Post Footing Depth Below Finish Grade: ASTM F 567.

E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F 567.

F. Brace each gate and corner post to adjacent line post with horizontal center brace rail _____. Install brace rail one bay from end and gate posts.

G. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

H. Install center brace rail on corner gate leaves.

I. Do not stretch fabric until concrete foundation has cured 28 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

K. Position bottom of fabric 2 inches above finished grade.

L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

N. Install bottom tension wire stretched taut between terminal posts.

O. Install support arms sloped inward and attach barbed wire; tension and secure.

P. Do not attach the hinged side of gate to building wall; provide gate posts.

Q. Install hardware and gate with fabric to match fence.

R. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

C. Do not infringe on adjacent property lines.

END OF SECTION 323113

SECTION 329119
LANDSCAPE GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Weeding.

B. Finish grading for lawns

C. Finish grading for planting areas.

1.02 RELATED REQUIREMENTS

A. Division 31 Section Site Clearing

B. Division 31 Section Earthwork

C. Division 32 Section Decomposed Granite Surfacing

D. Division 32 Section: Landscape Work

1.03 DEFINITIONS

A. Finish Grading: finish grading shall consist of adjusting and finishing soil surfaces with site or imported topsoil, raking grades to a smooth, even, uniform plane. Remove and legally dispose of all extraneous matter off site. Facilitate natural run-off water and establish grades and drainage indicated as part of the contract work.

B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 3/4-inches (19 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

C. Finish Grading: Finish grading shall consist of finishing surfaces by raking smoothly and evenly to facilitate natural run-off water, and by removing and disposing of extraneous matter.

D. Sub-grade: The surfaces upon which additional specified materials are to be placed, prepared, or constructed.

E. Rough Grade: The establishment of grades to required tolerances.

F. Finish Grade: Spot elevations (grades) are indicated based on the best available data. Contract Civil Drawings are referenced to provide additional site grading information. It is intended that constant slopes are maintained between spot elevations.

G. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.04 MATERIAL OWNERSHIP

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

1.05 EXISTING UTILITIES

A. Stake and mark the location of existing utilities before commencing work.

B. Retain and protect in operating condition all active utilities traversing the site designated to remain.

1.06 QUALITY ASSURANCE

A. Finish grade shall conform to contours, grades, lines, and shapes, as indicated on Contract Drawings, with uniform slopes between finish grades or between finish grades and existing grades.

B. Establish finish landscape grades in a continuous, uniform line, resulting in a uniform surface with no ridges or water pockets.

C. Finish landscape grade tolerance shall be 0.04-feet plus-or-minus from finish elevations indicated on site drawings.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS:

A. Topsoil: A natural, fertile, friable soil, free from stones, roots, clods larger than 1" in diameter, noxious seeds, weeds, subsoil, undesirable insects, plant disease or any other natural objects detrimental to normal plant growth.
   1. Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% passing 2.0-millimeter sieve.
   2. Total pore space content on a volume/volume basis shall be at least 15 percent at field capacity.
   3. Permeability rate shall be not less than one inch per hour or more than 20 inches per hour.
   4. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECE) shall not exceed 2.0 milliohms per centimeter at 25 degrees centigrade.
   5. Soluble boron shall be no greater than 1.0 part per million (mg/l).
   6. Soil pH range shall be 6.0 - 7.9.
   7. Maximum concentration of soluble chloride shall be 150 parts per million.
   8. Maximum concentration of heavy metals shall not exceed the following when the pH is between 6 and 7:
      a. Arsenic: 1 ppm
      b. Cadmium: 1 ppm
      c. Chromium: 5 ppm
      d. Cobalt: 1 ppm
      e. Lead: 15 ppm
      f. Mercury: 0.5 ppm
      g. Nickel: 2.5 ppm
      h. Selenium: 1.5 ppm
      i. Silver: 0.25 ppm
      j. Vanadium: 1.5 ppm
   9. Petroleum hydrocarbons shall not exceed 100 mg/kg dry soil.
   10. Aromatic volatile organic hydrocarbons shall not exceed 2 mg/kg dry soil.

B. Obtain imported topsoil from approved local sources.

C. All topsoil to be used for planting, regardless of whether import or on-site in origin, shall be tested as described in Part 3 of Section 329300.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verification of conditions: Prior to commencing the finish grading, review the installed work of other trades and verify that their work is complete.
   1. Rough Grading: Grading in planting areas (except raised planter areas) shall be established to within plus or minus 0.10 foot prior to beginning of finish grading.

B. Import topsoil only when necessary to supplement site soil to achieve grades shown on Drawings, or if site soil is unsuitable for planting.

3.02 PREPARATION:

A. Weeding: Before finish grading, weeds and grasses shall be dug out by the root or sprayed with an herbicide and disposed of off-site. This procedure is outlined in Section 329300-Landscape Work.

B. Remove debris, roots, branches, weeds, stones, in excess of 1/2-inch (13 mm) in size and clumps of earth that do not break up. Before and during finish grading, remove weeds and grasses, including roots, and dispose off-site.

C. Remove soil contaminated with petroleum products and legally dispose off-site.

3.03 INSTALLATION:

A. General: When rough grading and weeding have been completed, and the soil has dried sufficiently to be readily worked, lawn and planting areas shall be graded to the elevations indicated on the Drawings.
   1. Grades indicated on Drawing are grades that will result after thorough settlement and compaction of the soil.
   2. Grades not otherwise indicated shall be uniform finish grades and, if required, shall be made at the direction of the Architect.
   3. Finish grades shall be smooth, even, and a uniform plane with no abrupt change of surfaces.
   4. Soil areas adjacent to buildings shall slope away from the building to allow a natural run-off of water, and surface drainage shall be directed as indicated on the drawings by remodeling surfaces to facilitate the runoff water at 2% minimum grade.
   5. Low spots and pockets shall be graded to drain properly.

B. Drainage: Finish grade with proper slope to drains.
   1. Flow lines, designated or not, shall be graded and maintained to allow free flow of surface water.
   2. If any drainage problems arise during construction period due to Contractor's work (such as, but not limited to, low spots, slides, gullies and general erosion), the Contractor shall be responsible for repairing these areas to a condition equal to their original condition, and in so doing shall prevent further drainage problems from occurring.

C. Prior to placing backfill, remove rock, aggregate base, concrete, and deleterious materials to a depth of 18 inches below soil grade in planter areas. Cross-rip subsoil of friable soil to a depth of 12-inches.
   1. Place a minimum of 15-inches of topsoil backfill in planters.
   2. Refer to Section 329300 “Landscape Work” for soil materials.

D. Toe of slope: To prevent soil creep or erosion across pavement, where pavement (walk, curb, etc.) is at the toe of a slope, finish grade is to level out or swale slightly at least 12-inches before reaching pavement.

E. Moisture Content: The soil shall not be worked when the moisture content is so great that excessive compaction occurs, nor when it is so dry that dust may form in the air or that clods do not break readily. Water may be applied, if necessary, to provide moisture content for tilling and

planting operations. It is the Contractor's responsibility to control dust that is spread as a result of grading operations.

F. Grades: The finish grade in areas to be planted with turf shall be 1-inch below grade of adjacent pavement, walks, curbs, or headers. Finish grade in shrub areas shall be 1 1/2-inches below adjacent surfaces. Exceptions may be made when drainage conditions require flush grades, as directed by the Architect.

G. Compaction: Soils in planted areas shall be loose and friable, yet firm enough that no settling occurs from normal foot traffic or irrigation.

3.04 FIELD OBSERVATION:

A. It is the Contractor's responsibility to contact the Architect 48 hours or two working days in advance of each agreed observation or conference.

B. Schedule for On-Site Reviews: at completion of finish grading and prior to any planting operations.
   1. See "Site Observation" in Part 3 of Section 329300-Landscape Work to coordinate inspections and review of work.

END OF SECTION 329119

SECTION 329300
LANDSCAPE WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Soil Prep and Fertilization.
B. Planting Operation.
C. Planting Materials.
D. Topsoil and Planter Mix.
E. Agronomic Testing.
F. Drainage Materials.
G. Mulching.
H. Sod
I. Pruning
J. Tree stabilization.
K. Root Barriers.

1.02 RELATED REQUIREMENTS

A. Division 01 Temporary Tree and Plant Protection
B. Division 31 Section Site Clearing
C. Division 32 Section Landscape Grading
D. Division 32 Section Landscape Irrigation
E. Division 32 Section Landscape Maintenance
F. Division 33 Section Storm Drainage Utilities

1.03 REFERENCE STANDARDS

A. American Association of Nurserymen, Inc. (AAN)
   1. American Standard for Nursery Stock, latest edition (ANSI).

1.04 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.
C. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.
D. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than

minimum root spread according to ANSI Z60.1 for type and size of exterior plant required.

E. Root Zone: Imported specialty soil manufactured offsite by Gail Materials to be placed beneath turf fields.

F. Clump: Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.

G. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of exterior plant required.

H. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.

I. Finish Grade: Elevation of finished surface of planting soil.

J. Sub-grade Elevations: Excavation, filling and grading required to establish elevations is shown on drawings. Coordinate all work with grading contractor in order to arrive at rough grades that will allow tolerance for topsoil in planting areas, soil amendments and ornamental mulch as required in other sections of this specification. Contractor to assume tolerance of rough grades established at ± 0.09 feet (less than 1 tenths of a foot)

K. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

L. "Diameter at breast height" (DBH) is measurement for tree trunk caliper.

M. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.

N. Planting Soil: Native or imported topsoil; mixed with soil amendments.

O. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

P. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

Q. Pruning: As designated on contract drawings. Items not specifically indicated or specified, but normally required to conform with such work, are considered part of the work.

1.05 SUBMITTALS

A. WITHIN 30 DAYS OF START OF THE ROUGH GRADING OPERATIONS:
   1. Submit a certificate indicating all plant material has been secured for the project and is available.
   2. Submit documentation that all plant material has been ordered in accordance with Article 1.06 of this section.

B. CERTIFICATION: Submit the following:
   1. Certificates of inspection as required by governmental authorities when transporting materials into the state.
   2. Bulk Materials: Submit a certificate of delivery for all material in containers or bulk.

C. TEST REPORTS: Submit the following:
   1. Agronomic Soils Laboratory Test Report(s) including required amendments and maintenance recommendations.

D. PRODUCT DATA: Submit the following:

1. In accordance with Division 1 Section "Submittal Procedures", submit complete manufacturer descriptive literature and specifications for proprietary materials and any additional items required by the Architect. Prior to start of construction and submittals; furnish to the Architect the list of items to be submitted and reviewed.
    a. Soil Amendments (as identified in Agronomic Soils Report).
    b. Fertilizer (as identified in Agronomic Soils Report).
    c. Plant Tablets.
    d. Stakes and Guys.
    e. Tree Ties and Vine Ties.
    f. Mulch.
    g. Filter Fabric.
    h. Drainage Materials.
    i. Accessory Material.(Root barriers, Tree Grates, Metal edging, Boulders, etc.)
    j. Other soil additives per Agronomic Soils Report.
    k. Submit other data substantiating that materials comply with specified requirements. Such certificates may be tags, labels, and/or manufacturers literature. All submittals shall be reviewed and accepted by the Architect before contractor begins work.
    l. Substitution Request
        1) If any plant specified is not obtainable, submit a written substitution request to the Architect during the bidding period.
        2) Substitutions of plant material will not be permitted unless accepted in advance in accordance with the provisions of Division 1 Section "Product Requirements."
        3) The Contractor is responsible for contract growing all required plant material for to project to ensure availability in the size and requirements of the project.
        4) All substitution requests for any material must be made during the bid process. No substitution requests will be permitted after the bid process or during.
    m. With submittal of Bid Documents, submit complete list of plant materials to be provided, including unit prices for plants and for installation. Include:
        1) Quantity.
        2) Size.
        3) Botanical Name.
        4) Plant Unit Price.
        5) Installation Unit Price.
2. PLANTING SCHEDULE: Submit proposed planting schedule at least two months prior to planting any materials, indicating dates for each type of landscape work coinciding with normal seasons for such work. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. If dates need to be revised after acceptance of planting schedule, document reasons for delays and submit for acceptance.
3. Submit two photos of each tree(include DBH, height and spread), shrub(include height and width) and groundcover(include height and width) with a person in the image to be used on the project to the architect for review. Photos are to be of the actual material tagged, or secured and that will used for the project at the sourced nursery. No plants may be delivered or planted prior to approval by Architect.

1.06 QUALITY ASSURANCE

A. QUALIFICATIONS
1. Nursery Qualifications: Regularly engaged, for the preceding ten years, in the production of planting materials equivalent in species and size to those required.
    a. Stocked, and having a demonstrated ability to provide plant materials required within the constraints of the accepted construction schedule.

b. Landscaper's Qualifications: Regularly engaged and specializing, for the preceding ten years, in the installation and maintenance of planting materials equivalent in species and size to those required.
   1) Capable of furnishing a verifiable list of not less than five projects of equivalent type successfully completed within the preceding two years.
   2) Subcontracts: Landscape work to a single firm specializing in landscape installation.

2. Pre-Installation Conference: Schedule in advance of beginning work of this section. Arrange for attendance by Owner, Architect, and landscaping subcontractor. Review intent of Contract Documents and resolve conflicts. Prepare minutes of conference and distribute to attendees within five (5) days.
3. Source Quality Control
   a. General: Comply with regulations applicable to shipping of landscape materials.
   b. Analysis and Standards: All materials shall be of standard, approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacture's guaranteed analysis. The Contractor shall supply the Architect with a sample of all materials accompanied by analytical data from an approved laboratory source illustrating compliance of bearing the manufactures guaranteed analysis.
4. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
5. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
   a. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
6. 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 3/4-inches (19 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
   a. Obtain topsoil only from naturally, well drained sites where topsoil occurs in a depth of not less than 4"; do not obtain from bogs or marshes. All topsoil is to be tested and analyzed by an independent laboratory before delivery to site, as indicated in Article 3.03.
7. Contractor shall provide the Architect with location of soil, crops previously planted on such soil within the last two years, and the USGS soil survey classification and name.
8. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1-1980 "American Standard for Nursery Stock". Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free from disease, insects, insect eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, overlapping surface roots, or disfigurement. Central leaders of all trees shall be intact, undamaged, with evenly spaced lateral branches.
   a. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above the ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the ground for larger sizes. Measure

main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

9. Label all trees and shrubs with securely attached waterproof tag bearing legible designation of botanical and common name. Where formal arrangements and consecutive order of trees is shown, select stock for uniform height/spread, and label with number to assure symmetry in planting.
10. Stock Review: The Architect will review trees and shrubs at site before planting with requirements for genus, species, variety, size and quality. The Architect retains right to further review trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of the work. Remove rejected vegetation immediately from project site. Contractor shall request review of such stock by the Architect by delivering notice, in writing, 72 hours in advance.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver exterior plants freshly dug.

B. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

C. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.
1. Protect plants from sun or drying winds. Protect and maintain plants that cannot be planted immediately upon delivery.
2. Do not drop plant material.
3. Do not pick up container planter material by stems or trunks.
4. Protect from wind.
5. Water as required.
6. Do not prune trees and shrubs before delivery except as approved by Architect. Do not bend or bind trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery, and provide protection on site from traffic, pedestrians, and deleterious effects of climate while planting operations are in progress. Dropped or damaged stock will not be accepted.
7. Deliver trees and shrubs after preparations for planting have been completed and plant immediately after approval of plant materials locations. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture. Do not remove container grown stock from containers until planting time.
   a. Do not pick up plants by stems or truck. Handle planting stock by root ball.
   b. Do not remove container - Grown stock from containers before time of planting.
   c. Water root systems of exterior plants stored onsite with a fine-mist spray.
   d. Water as often as necessary to maintain root systems in a moist condition.
8. Plant material shall not be stored on the jobsite for more than 48 hours before planting. Contractor shall schedule nursery deliveries in sub-groups as necessary to comply with this requirement.
9. Deliver accessory materials in manufacturer's original, unopened packaging with identifying labels affixed and legible in accordance with state law. Deliver plants with identifying tags affixed. Contractor shall notify Architect 72 hours in advance of plant material delivery for observation. Review plants with Landscape Architect to confirm that they are the plants which had previously been tagged and supplied. The Architect reserves the right to reject the following:
   a. Plant materials not identifiable as previously selected.
   b. Materials not accompanied by required certificates.

c. Plant materials where damage to rootball, trunks, or desiccation of leaves has been caused by inadequate protection during delivery.
d. Plant material not matching the form, shape, or growth habit required for the design intent of the Project.
e. Horticultural or visual defects in material.
f. Plant material pruned prior to delivery.
g. Plant material with detrimental pests.

1.08 PROJECT CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.
1. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of substantial completion.
a. Plant or install materials during normal planting seasons for each type of landscape work required.
2. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed without having detrimental effects on the plant material, or finished product.
3. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns unless otherwise acceptable to Architect.
a. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.
4. Contractor shall verify locations of all existing utilities, whether shown on plans or not. The Contractor shall notify members of Underground Service Alert (DigAlert) two (2) working days in advance of performing any excavation work by calling the toll-free number 1-800-227-2600 or 811.
5. After determining location of underground utilities, perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
6. When conditions detrimental to plant growth are encountered, such as rubble fill, hardpan condition, adverse drainage conditions, or obstructions, notify the Architect before planting. Remove all material deemed unsuitable for plant growth as directed by the Architect.
7. No landscape materials may be planted before an irrigation operation and coverage test is completed by the Architect.
8. No landscape materials may be planted before finish grade is reviewed by the Architect.
9. Existing Trees:
a. Prior to the beginning of any clearing, grubbing, trenching, or excavation on site, the general contractor, grading contractor, project arborist, landscape contractor, and the Architect shall meet in a pre-construction conference to discuss grading near existing trees.
b. The contractor shall protect all existing trees and shrubs scheduled to remain against injury or damage, including cutting, breaking or skinning of roots, trunks or branches. No blasting of rock shall occur in any area adjacent to existing trees without prior written consent of the Architect.
c. No trees or shrubs are to be removed, trimmed, or cut without prior approval of the Architect and Arborist.
d. Prior to the beginning of the clearing and grading phase of the project, a continuous, temporary, six foot (6') high chain link fence shall be erected around the drip line of all trees scheduled to remain, unless otherwise specified by the Architect. The temporary fencing shall be erected prior to commencing any other work on the project. No construction activity shall be allowed within the limits of this fencing unless directed by

the Architect. The temporary fencing shall remain in place during the entire construction period and shall not be removed until directed by the Architect.

e. Grading beneath trees to be saved shall be given special attention. Every effort shall be made to avoid creating conditions adverse to the tree's health. The natural ground within the drip lines of trees to be preserved shall remain as undisturbed as possible. Grading within the protected root zone of trees to be preserved will not be permitted unless specifically approved by the Architect and Arborist prior to beginning of proposed grading.

f. If during construction or grading (grading, excavation, etc.) tree roots of 2" in diameter or greater are encountered, work shall stop immediately and a Certified Arborist, approved in advance by the Architect, shall be contracted for a root inspection. Root cutting of any roots over 2" in diameter must have prior approval from the Architect. All cuts are to be made with appropriate equipment, as to not affect the plant material.

g. Major roots one inch (1") or greater in diameter encountered within the drip line of the tree in the course of excavation or trenching shall not be cut and shall be kept moist and covered with earth as soon as possible. Shredding of roots or damaged caused by trenching or grading equipment is not permitted.

h. Roots one half inch (1/2") to one inch (1") in diameter which are severed shall be trimmed cleanly and covered with earth as soon as possible.

i. All trenching beneath the drip line of trees to remain shall be done with hand tools only. No mechanical trenching or excavation is allowed within the drip line of existing trees at any time, or where roots are encountered outside the dripline of the tree.

j. Branches interfering with construction but not designated for removal may be removed only as directed by the Architect and Arborist.

k. Any pruning, cutting, or trimming of any trees will be performed by an International Society of Arboriculture Certified Arborist or certified tree worker or in accordance with the National Arborist Association and/or International Society of Arboriculture pruning standards. Cutting of 2" diameter limbs or greater or major dead wooding shall require approval of the Architect.

l. Trees or shrubs scheduled to remain and damaged by construction operations shall be repaired by the contractor in a manner acceptable to the Architect and Arborist. Damaged trees and shrubs shall be repaired promptly to prevent progressive deterioration. Repair or replacement of trees and shrubs shall be at the contractor's expense as determined by the Architect. Contractor shall be held fully liable for damage caused to trees and shall be assessed fees based on the International Society of Arboriculture "Guide for Plant Appraisal", as determined by the project Arborist; fees will be assessed for: 1) any injury to the trunk, limbs, or root system, and (2) for the value of any tree requiring removal subsequent to injury or treatment that varies from these Specifications.

m. Parking of vehicles, equipment or storage of materials under the drip line of existing trees shall not occur at any time.

n. Wash all existing and new trees weekly to remove dust and debris during construction.

1.09 SCHEDULING

A. Within 30 days after the commencement of initial grading, furnish documentation to the Architect that all plant material has been secured for the project and is available. Contractor shall be responsible for payments and deposits required by the grower or plant consultant to secure, maintain, and grow plant material indicated on the Contract Drawings.

1.10 WARRANTY

A. Special Warranty: Warrant all plant material in writing where installer agrees to repair or replace plantings and accessories that fail in materials, workmanship or growth within specified warranty period.
   1. Failures include, but not limited to, the following:
      a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by owner.
      b. Structural failures including plantings falling or blowing over including during high wind events.
      c. Faulty operation of tree stabilization edgings tree grates.
      d. Deterioration of metals, metal finishes and other materials beyond normal weathering.
      e. Material not thriving.
      f. Warranty periods begin from date of final completion:
         1) Trees, vines, shrubs: One year.
         2) Ground cover and turf: One year.
   2. Warrant plant material, installed, or relocated under the contract, in writing, for a period of one year (after beginning of maintenance period) against defects including death, and unsatisfactory growth, except for defects resulting from neglect, abuse or damage by others.
   3. Remove and replace trees, shrubs or other plants found to be dead, yellowing, defoliating, or in unhealthy condition, or other defective materials during warranty period at no additional cost to the Owner. Replace trees and shrubs, which in the opinion of the Architect, are in unhealthy condition at end of warranty period. The Architect shall be the sole judge as to the condition of the material. All replacement materials and installation shall comply with the drawings and specifications. Another inspection may be conducted at end of warranty period to determine acceptance or rejection.
   4. Upon receipt of written notice from Owner of the loss of any warranted plant materials during the warranty period, the subject plant materials shall be promptly replaced with the same species originally planted, and of a size closely approximating the size of the plant, if normal growth had occurred since the original planting. Replacements shall be subject to the requirements of this specification.
   5. When plants are replaced, advise the Owner, in writing, of the new establishment maintenance period equal to the one year.
   6. Plant material must be replaced within ten (10) days of written notification, and shall be installed in accordance with these specifications.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by the following.

B. California (Southern)
   1. Stabilizer, Inc. Phoenix, AZ 800-325-5360.
   2. MacLean Civil Products, Fort Mill, SC 800-925-5360.(check for local distributor)
   3. Agrono-Tec Seed Co., Wildomar, CA, 800-543-4109.
   4. Aguiñaga Fertilizer Co., Inc., Irvine, CA, 949-786-9558.
   5. Gail Materials, Corona, CA, 951-664-6106.
   6. KRC Rock, San Marcos, CA, 800-427-0572.
   7. Mirafi, Inc., Charlotte, NC 800-438-1855, represented by James Heidt & Associates, Montrose, CA, 818-248-9677/800-233-0512.
   8. NDS Drainage Products, 800-726-1998.
   9. Quality Turf, Temecula, CA, 800-721-4800.

10. Pacific Sod, Camarillo, CA, 800-762-3027.
11. Permaloc Corporation, Holland, MI, 616-399-9600.
12. Soil and Plant Laboratory, Inc., Orange, CA, 714-282-8777.
13. Southern California Organic Fertilizer Company, El Monte, CA, 714-750-3830.
14. Southland Sod Farms, Port Hueneme, CA, 805-488-3585.
15. Stabilizer, Inc., Phoenix, AZ, 602-952-8009/800-336-2468.
16. V.I.T. Company, Escondido, CA, 760-480-6702.
17. West Coast Turf, Las Vegas, NV, 800-649-8873.
18. Whitecap, Inc., Santa Ana, CA, 714-258-3300.
19. Whittier Fertilizer, Pico Rivera, CA, 310-699-3461.
20. EPIC Plastics, Cerritos, CA, 562-403-3848.
21. Wallace Labs, El Segundo, CA, 310-615-0116.
22. Materials shall be the products of one manufacturer and shall be either the ones upon which the design is based, or the products of manufacturer accepted in advance. No substitutions will be permitted.

2.02 SOIL

A. TOPSOIL: Site to be rough graded to elevations shown on Civil Drawings. Topsoil will be required behind curb areas and in planting area. Provide on-site, import, or non-processed topsoil in planting areas as needed to complete rough grading which is fertile, friable, and natural loam in accordance with Article 2.3. Topsoil shall be from agricultural sources, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 3/4-inch in any dimension, and other extraneous or toxic matter harmful to plant growth.

B. All topsoil to be used for planting, regardless of whether import or on-site in origin, shall be tested as described in Part 3 of this Section.

C. Root zone for sand based turf and materials.
   1. Pre-manufactured soil by Gail Materials.
   2. Sand: Refer to detail on approved plans for depth
      a. Meet the following gradation:

Sieve No.	Percent Passing (by weight)
3/8 inch	100
8	75-100
16	40-100
30	0-50
50	0-12
100	0-5

      b. Chemistry
         1) Salinity: Saturation extract conductivity (ECe) shall be less than 3.0 dS, @ 25 degree C.
         2) Sodium: Sodium absorption ratio (SAR) shall be less than 6.0.
         3) Boron: Saturation extract concentration shall be less than 1.0 ppm.
         4) Reaction pH of saturation paste shall be 5.5 to 7.8 without height lime content.
   3. Bark: 1 to ¼ inch fir or pine bark. Refer to planting details for depth.
      a. Particle Size Distribution:

Sieve No.	Percent Passing
3/8 inch (9.51mm)	100

Sieve No.	Percent Passing
1/4 inch (6.35mm)	95
0.02 inch (500 micron)	0-30

b. Minimum 90 percent organic by dry weight as determined by ash method.
c. pH shall be in the range of 4.0-5.5 as determined in saturation paste.
d. Salinity shall not exceed 2.0 dS/m as determined in saturation extract.
e. Dry bulk density shall be in the range of 400 to 580 pounds per cubic yard.
f. Fir or pine sawdust or greenwaste compost are not acceptable alternatives.

4. Soil Mixture: The soil mixture shall be a bind of one part 0-1/4 fir or pine bark and 6 parts of specified sand. Refer to approved details for depth. The following amendments shall be added and uniformly blended at tan offsite facility (equal to Gail Materials) into the sand bark mixture prior to placement on the field.
   a. Nitroform (38%N, 27% WIN): 2/3 pound
   b. 6-20-20 Commercial Fertilizer: 1 pound
   c. Solomitic Limestone (Kaiser AG 65): 1.5 pounds
   d. Iron Sulfate (31% Fe): 5 ounces
5. Location(s)
   a. Use in designated field areas.
   b. Depth shall be per details.
   c. Available through Gail Materials, Corona, CA (951) 667-6106
   d. Contact: Dave Dzwilewski

2.03 SOIL AMENDMENTS

A. The initial application of fertilizers and amendments to be tilled into the soil during soil preparation operations shall be established after soil testing has been conducted by Contractor. An estimated quantity is indicated below for bid purposes only. This estimated quantity does not include mulching, fertilizer tablets, additional topsoil necessary to meet specified grades and fertilizer applications for after planting. After soils analysis recommendations are made to the Architect quantifying the actual amount of amendments required and recommendations have been accepted by the Architect, the Contractor shall, without delay, determine any cost impacts whether credit, no change, or addition, to the Contract Amount. As an integral part of the bid for Landscape Work, provide a Lump Sum bid amount for fertilizers and amendments as described below.

B. Application Rates (FOR BID PURPOSES ONLY):
   1. Sixty (60) lbs. of Tri-C Humate per 1,000 square feet.
   2. Nineteen (19) lbs. of 6-20-20 fertilizer per 1,000 square feet.
   3. Six (6) cubic yards of Aguiñaga GPS2, nitrogen stabilized compost per 1,000 square feet.
   4. 50-lbs Agricultural Gypsum, per 1,000 square feet.

C. Pot or Raised Planter Soil Mix: Prepare and backfill pots with a mix of the following per cubic yard:
   1. Jardinier Capillary Soil
   2. 12-12-12 Commercial Fertilizer
   3. Organic Amendment - 1/3 cubic yard
   4. Fine Sand - 1/3 cubic yard
   5. 12-12-12 Commercial Fertilizer - 1 pound
   6. Iron Sulfate - 2 pounds

D. Actual amendment rates and type shall be per soil test recommendations.

E. Imported Topsoil
   1. Provide natural, fertile, friable soil free from stones, noxious weeds, seeds, roots, subsoil or other material detrimental to normal plant growth. Topsoil acidity range (pH) shall be

between 6.5 and 7.5 containing a minimum of 4 percent and a maximum of 25 percent organic matter.

2. Reuse surface soil stockpiled onsite. Verify suitability of stockpiled surface soil to produce top soil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
    a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain top soil displaced from naturally well drained sites where topsoil occurs at least 4 inches deep; do not obtain from [agricultural land], bogs or marshes. Obtain soil from local sources acceptable to the Architect.
    b. Silt plus clay content of soil shall not exceed 15 percent by weight with a minimum 95 percent passing a 2 millimeter sieve.
3. Obtain imported topsoil from local sources acceptable to the Architect.
4. Silt plus clay content of soil shall not exceed 15 percent by weight with a minimum 95 percent passing a 2-millimeter sieve.

F. Organic soil amendment:
1. "Nitrified Redwood Compost": 0.56 to 0.84% N based on dry weight, treated with relative form of nitrogen (NH3).
    a. Particle Size
    b. 95% - 100% passing 6.35 mm standard sieve.
    c. 80% - 100% passing 2.33mm standard sieve.
    d. Salinity: The saturation extract conductivity shall not exceed 3.5 millimhos/centimeter at 25 degrees (25N) centigrade as determined by saturation extract method.
    e. Iron Content: Minimum 0.08% dilute acid soluble Fe on dry weight basis.
    f. Ash: 0 - 6.0% (dry weight)
    g. Acidity range (ph) shall be between 5.5 and 7.5.
    h. Actual organic content shall be a minimum 280 pounds (lbs.) per cubic yard.
    i. As available from: Redi-Grow Corporation, 909 Elder Creek Road, Sacramento, CA 95828
2. Organic soil amendment shall be Aguinaga GPS2.
3. Particle Size:
    a. 90-100 percent passing 6.35 mm standard sieve.
    b. 80-100 percent passing 4.75 mm standard sieve.
4. Salinity: The saturation extract conductivity shall not exceed 6.5 milliohms/centimeter at 25 degrees Centigrade as determined by saturation extract method.
5. Iron Content: Minimum 0.08 percent dilute acid soluble iron on dry weight basis.
6. Actual organic content shall be a minimum of 280 pounds (lbs.) per cubic yard.

G. Fertilizers
1. Tri-C Humate. Provide per manufacturers specification.
2. Fertilizer Tablets: Fertilizer Tablets: The following is to be used in the planting of container grown material. Follow manufacturer's application rates.
    a. Best-Paks "20-10-5" fertilizer packets. Packets to be made up of a minimum of 20% Nitrogen, 10% Phosphorus, 5% Potash. Use 1 Pak per 1-gallon container, (G.C.), 3 Paks per 5 G.C., 9 Paks per 15 G.C. and 12 Paks per boxed specimen. Evenly distribute as shown in details.
3. Commercial Fertilizer: First Quality Commercial Fertilizer, as specified in Agronomic Soils Report.

H. Related Materials:
1. Pre-Planting Herbicide: Phydura, or equal.
2. Pre-Emergent Weed Control: Ronstar-G, Treflan, Eptam, Vegitex, or equal.
3. Peat Moss: Sphagnum peat moss, Canadian or European variety, free from alkali.
4. Soil Sulfur: First quality commercial grade.

5. Ferrous Iron Sulfate: Chelated first quality commercial grade.
6. Agricultural Gypsum: First quality commercial grade.
7. Best "Ammonium Phosphate" 16-20-0 with net less than 16% total nitrogen, 20% available phosphoric acid and 0% soluble potash.
8. Good Humus.
9. Root Hormone: Super Thrive.

2.04 PLANT MATERIALS

A. Quality: Provide trees, shrubs, and other plants of size, form, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock".

B. Deciduous Trees: Provide trees of height and caliper scheduled or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.
   1. Lateral scaffolds shall be radially distributed around the trunk. The lateral branch shall be no more than 2/3 the diameter of the trunk. Trunk to be measured 1" above the branch (lateral scaffold).
   2. The minimum acceptable length of the most recent season's shoot growth for slow growing trees shall be not less than 8"; for fast growing trees not less than 12".
   3. The minimum acceptable height of trees is 6'-0" when planted, or as determined by Architect.
   4. Needle Leafed and Broad Leafed Evergreen Trees: Provide evergreens of sizes shown or listed. Where dimensions are shown, they indicate minimum spread for spreading and semi-spreading type evergreens and height for other types, such as globe, dwarf, cone, pyramidal, broad upright, and columnar. Provide normal quality evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension shown.
      a. The minimum acceptable height of trees is 6'-0" when planted, or as determined by Architect.
   5. Multi-Trunk Trees: Provide sizes shown or listed. Tree is to have a minimum of three (3) dominant trunks with appropriate caliper size and adequate spread.
   6. Shrubs: Provide shrubs of the size shown and with not less than the minimum number of canes required by ANSI Z60.1 for type of shrub required. Provide container grown stock.
   7. Ground Cover: Provide plants established and well-rooted in removable containers, in flats, or integral peat pots and with not less than minimum number and length of runners required by ANSI Z60.1 for the size shown or listed.
   8. Vines: Provide vines with good, well-established root systems within the container, and devoid of any abrasions, and or damage to stem.

2.05 SOD

A. Lawn Sod:
   1. Nursery-grown sod shall have the following characteristics:
      a. Sod for planting areas shall be dense, healthy, field-grown on sand fumigated soil with the grass having been mowed at 1-inch height before lifting from field.
      b. Sod for grass pave areas shall be dense and healthy, grown on a sand bed thin cut and washed.
      c. Sod shall be dark green in color, relatively free of thatch, free from disease, weeds and harmful insects.
      d. Sod shall be reasonably free of objectionable grassy and broadleaf weeds. Sod shall be considered weed free if no more than 2 such weeds are found per 100 square feet of sod.
      e. Sod shall be rejected if found to contain the following weeds: common Bermuda grass, quack grass, Johnson grass, nimble weed, thistle, bindweed, bentgrass, perennial sorrel,

and bromegrass.

f. Sod variety shall be:

1) Turf Grass: Pro Sportsfield Supreme, as produced by Stover Seed.

2. Lawn Seed:

a. Turf Grass: Seed mix shall consist of 35% Rainwater Perennial Ryegrass, 35% Manhattan 7 GLR Perennial Ryegrass, 30% Royal TXD Improved Bermudagrass (coated) at the rate of 500 lbs. /acre.

b. Fertilizer: Combination of 16-20-20 and "Endure" 15-15-15 at a rate of 5 lbs. /sf.

c. Fiber: Hydro blanket at 60 lbs. /1,000sf.

d. As indicated on Contract Drawings.

2.06 MISCELLANEOUS LANDSCAPE MATERIALS:

A. Tree Stakes: Provide stakes of sound new lodgepole pine 2 inch minimum diameter for 15 gallon to 24 inch box size trees; 3 inch minimum diameter for 36 inch box and larger. Lodge pole minimum height, as indicated on Contract Drawings. Stakes shall have been treated with copper napthanate or ACQ (alkaline) or Ca-B (copper azole) to a minimum wood depth of 1/16". All stakes shall be free of knots larger then 1/2" in diameter, holes and other defects.

B. Tree Straps: Provide VIT black tree straps. Tree straps shall be attached to tree stake as shown in staking detail on the plans, color to be black.

1. VIT "Cinch-Tie" for 24-inch box size and smaller tree.
2. VIT "Cinch-Belt" for 36-inch box size and larger tree.

C. Mulch

1. Rock Mulch: As indicated on drawings. All 1/2-1-inch "Palm Springs Gold" aggregate rock mulch shall be washed twice by Contractor and shall be clean prior to installation.
2. Bark Mulch:

a. Mulch shall be shredded bark mulch, as manufactured by Whittier Fertilizer, Pico Rivera, CA.

1) Mulch shall consist of shredded bark mulch with a particle range of 2-3/4-inch to 1-inch in size.

3. Weed Control Fabric: Place Mirafi Mirascape landscape fabric below rock mulch or as shown on drawings. Overlap all seams 12" minimum and pin down every 36" typical. Mirascape fabric available from: Towns & Associates, 800-222-6036

D. Root Control Barriers: High-density polyproylene root control planter. Acceptable products include:

1. Deep Root; Deep Root Corporation.
2. Size as specified on drawings.

E. Drainage Materials

1. Gravel in raised planters on structural slab and in pots shall be clean, coarse 3/8-inch to 3/4-inch diameter.
2. Gravel for tree drainage shall be 3/4" diameter coarse clean gravel.
3. Synthetic filter membrane cover over drainage course shall be woven synthetic fabrics.

a. Model 140N, as manufactured by Mirafi.

4. Drain Pipe at trees: 4-inch diameter PVC perforated(within gravel), and non-perforated PVC drain pipe(stand pipe) with PVC adaptor connected to 4-inch ABS female reciever with 4-inch black ABS cleanout plug.

F. Jute Netting: A uniform open plan weave, single jute yarn not varying in thickness by more than 1/2 of its normal diameter, in rolled strips approximately 50 to 75 yards long and 50 to 60 inches wide. Contractor shall submit sample for approval prior to installation.

G. Staples: 11 gage with 1-inch top and 6-inch legs.

H. Sod Pegs: 1-inch square by 6-inch long pine or 6-inch lengths of lath.

I. Weed Control: Phydura, or equal.

J. Landscape Drainage System:
   1. Catch Basin: NDS Model #1200 12x12 catch basin; black color with NDS #1217 riser extension as necessary.
   2. Grate: NDS Model #1290 atrium grate in planter area, NDS Model #1211 in turf area; black color.
   3. Outlet adapter: NDS Model#1266 universal outlet; as necessary. NDS Model #1206 universal plug; as necessary.
   4. Pipe: PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM D 3034, SDR 35, for solvent cement.
   5. Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected, and Architect has reviewed and accepted materials as defined within the section.

3.02 SITE OBSERVATION SCHEDULE

A. General: Notify Landscape Architect at least 3 days in advance when requesting on-site reviews.

B. Prior to commencement of site visits, items noted in previous observation reports shall have been either completed or remedied, unless such compliance has been waived. Failure to complete prior tasks or failure to prepare adequately for scheduled observations shall obligate Contractor to reimburse Architect for additional hourly services, plus transportation costs

C. Schedule For On-Site Reviews by the Landscape Architect:
   1. Pre-construction conference with general contractor, grading contractor, landscape contractor, project arborist and landscape architect to discuss grading and protective measures to be followed in the vicinity of existing trees, or existing structures.
   2. At completion of finish grading, and roto-tilling
   3. Review of irrigation coverage prior to installation of any planting material.
   4. At completion of fine grading and at delivery of plant materials, together with plant layout; prior to excavating pits.
   5. Review of drainage system, standpipes, and plant material locations.
   6. After planting pits have been excavated, but prior to backfilling. Provide one sample plant pit mock up for review.
   7. After initial planting operations (One tree with each type of specified staking shall be approved prior to planting of trees).
   8. See "Final Review and Acceptance" at the end of Part 3 in this Section for final site observations and acceptance of work.

3.03 TESTING

A. Planting Soil: Agronomic Soil Testing
   1. Test shall be paid for by the Contractor. Testing lab shall be:
      a. Wallace Labs, El Segundo, CA

b. Waypoint Analytical, Anaheim, CA
c. Agronomic Soils Testing
   1) Take one samples of site soil at a depth of 6 to 12 inches, within proposed planting areas, after completion of final grading and prior to weed control and soil preparation.
   2) Take samples to agronomic soils testing laboratory indicated above for soil evaluation.
   3) Request testing for fertility and suitability analysis with written recommendations for soil amendment, fertilizer and chemical conditioners, application rates for soil preparation, planting backfill mix, pot-soil mix, hydro-spray, and post-maintenance fertilization programs.
   4) Soils report recommendations shall take precedence over the amendment and fertilizer application rates specified in this section.
   5) Submit testing laboratory's interpretation, recommendations, and comments to Architect within 14 days after the completion of rough grading.
d. Furnish a soils analysis of import soil, and organic soil amendment prior to backfill.
   1) Submit soil testing laboratory's findings to Architect within 5 days prior to backfilling.
e. Take one additional soil samples after completion of planting in the soil preparation and backfill mix areas, to be determine effectiveness to amendments prior and during planting. Submit to the testing laboratory the original amendment specification with previously issued bulletins for soil amendments and installation procedures. Re-apply necessary amendments based on recommendation of new soils test.

3.04 PREPARATION

A. Final Grades
   1. Finished grading shall insure proper drainage of the site. Conform to Division 31 Section "Earthwork" and Division 32 Section "Landscape Grading."
   2. The following areas shall be graded so that the final grades shall be established below adjacent paved areas, sidewalks, valve boxes, headers, clean outs, drains, manholes, etc. before placement of mulch as follows:
      a. Shrub/Groundcover Areas: 1-1/2 inches.
      b. Turf areas: 1-inch.
      c. Surface drainage shall be away from all building foundations, 2% minimum.
      d. Dispose of excess or unacceptable soil from the site at no expense to the Owner.
      e. Verify that final grades have been established prior to beginning planting operations.
   3. Parking Lot Planters and areas adjacent to hardscape.
      a. All aggregate base rock, lime-treated soil, soil sterilents, and other non-organic materials shall be removed from all parking lot planter areas down to the level of native soil. Scarify native soil to a depth of 12 inches and backfill planters to specified finish grade with native or approved topsoil and amend as specified.
      b. Remove all concrete overpours or any material that may prohibit the placement of plant material, irrigation, grates, root barriers, or any other conflicting material.
   4. Protect planting areas from compaction by foot, trucks and heavy equipment.

3.05 PLANTING BED ESTABLISHMENT

A. Preparation Of Planting Area
   1. Cross-rip on-grade planting areas to a minimum depth of 12 inches minimum 2 perpendicular directions. Remove stones over ½ inch (13mm) in any dimension and sticks, roots, rubbish and other deleterious matter per Division 32 "Landscape Grading".

2. Where additional soil is needed, place the top 15” with topsoil. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil.
3. Leach soil prior to amending.
4. After approximate finished grades have been established and soil has been leached, soil shall be conditioned and fertilized in the following manner: Soil condition shall, at the rate specified in the approved soils test recommendations, be uniformly spread and cultivated thoroughly by means of mechanical tiller into the top (8) eight inches of soil.
5. Broadcast soil amendments uniformly over surface of the area to be treated. Roto-till the top (8) eight inches of planting areas to evenly distribute the amendments and conditioners into the soil.
6. Retest as required to verify leaching was successful. All soil areas shall be compacted and settled by application of irrigation to a minimum depth of six (6) inches prior to any plant materials being installed.
7. At time of planting, the top 12 inches of all areas to be planted shall be free of stones, stumps, or other deleterious matter one 1/2 inch in diameter or larger, and shall be free from all debris, or similar objects that would be a hindrance to planting and maintenance.
8. Weed Eradication:
    a. Manually remove all existing vegetation in planting areas and dispose of it offsite.
    b. Fertilize planting areas with urea 30-0-0 commercial fertilizer at the rate of 0.5 pounds per 1000 square feet.
    c. Water planting areas thoroughly and continuously(by irrigation system, hand/hose, water truck, or other) for a period of 3 consecutive weeks, or until the weed seed have germinated. If accepted in advance by the Landscape Architect, employ a specific watering duration and frequency program designed to germinate residual weed seeds.
    d. Discontinue watering process for 2 days. Then apply a non-selective broad spectrum systemic herbicide for perennial weeds.(2 applications minimum) The type of herbicide to be used shall be determined by a licensed pest control applicator. If annual weeds are present, use straight contact herbicide in accordance with pest control applicator's recommendations.
        1) Do not use a pre-emergent herbicide.
    e. Allow sufficient period of time to ensure that weeds are dead. Follow herbicide manufacturer’s directions.
    f. Water planting areas thoroughly and continuously (by irrigation system, hand/hose, water truck or other)for a period of 3 weeks. A shorter watering period may be permissible at the discretion of the Landscape Architect. Discontinue watering process for 1 day prior to the second application of the herbicide spraying.(2 applications minimum) Re-apply the spraying operation with straight contact weed killer in accordance with pest control adviser's recommendations.
        1) Do not use a pre-emergent herbicide.
        2) Avoid irrigation for a minimum of 4 days for effective final weed kill.
    g. Clear desiccated weeds from the area.
    h. Water Planting areas thoroughly and continuously for 3 consecutive days to saturate upper layers of soil prior to planting operations.
    i. Allow planting area soil surface to dry out for I day only prior to the planting application. Exercise care to not allow the soil surface to be either super-saturated with water or bone dry prior to the planting installation. Ensure moderate residual moisture within the top 1/4 inch of the soil surface.
    j. The hydraulic equipment used for pesticide applications shall consist of an ISO-gallon minimum capacity fiberglass tank with complete mechanical agitation. The pump capacity shall be 10 gallons per minute while operating at a pressure of 100 pounds. Per square inch.

k. Distribution lines shall be large enough to carry the volume of water necessary for even, chemical distribution. The spray nozzle must cover a IS-foot swath, with a minimum output of 5 gallons per minute at 80 pounds per square inch.

9. Pre-emergent Weed Control: Immediately after planting, apply pre-emergent weed control to planted areas which will not be seeded.

10. Excavation For Trees And Shrubs

a. Excavate pits, beds, and trenches as shown in details on the drawings.

B. Preparation for Lawn Areas: Limit preparation to areas which will be planted promptly after preparation.

1. Prepare planting area as described in 3.05 A.

2. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Establish smooth uniform surface. Limit fine grading to areas which can be planted immediately after grading.

3. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

4. Restore lawn areas to specified conditions if eroded or otherwise disturbed after fine grading and prior to planting.

3.06 ROOTZONE FOR SAND BASED TURF

A. The thoroughly mixed root zone material shall be placed on the areas designated for turf (except for areas designated for grass pavers) and firmed to a uniform depth of 6 inches (300mm) with a tolerance of +1/4-inch (6mm). Mix shall be moist when spread to discourage migration in to the subgrade and to assist forming.

B. Soil mix shall be separated from drainage courses with geotextile fabric equal to Mirafi 140N.

C. See Planting Plans for turf locations.

3.07 SOD

A. Sod shall be laid with closely fitted joints on a smooth, level surface which has been prepared as previously specified. Ends of strips shall be staggered. On irregular areas, sod shall be laid in both directions from the longest straight line that can be drawn through the area.

B. After a light initial watering immediately after installation, the sod shall be rolled to eliminate all irregularities.

C. After compaction, the sodded area shall be wetted to a soil depth of at least 8 inches.

D. Sod shall be as specified on the Contract Drawings

E. Protect sod from pedestrian traffic for 21 days and from sports activity for 6 weeks.

F. Sod is to be rolled minimum two times or as often as required in two directions with a water ballast roller to remove variations in grade. Sand infill all depresses. Sand to comply with turf manufacturer recommendations.

G. Sod is to be machine placed from “Big Rolls”.

3.08 PLANTING

A. General

1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Architect.

2. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.

3. Container shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure acceptance by the Architect before start of planting work. Make minor adjustments as may be requested.

C. Excavation for Trees and Shrubs:
1. Excavate pits, beds and trenches as shown in details on the Drawings.
2. Roughen and score edges of planting pit to eliminate any glazing of the sides of the pit.
3. Field Samples: Prior to planting, prepare one plant pit with standpipe, gravel, filter fabric, and root barriers for each tree size to be reviewed by the Architect.
4. Do not cover standpipes.
5. Excavation for planting shall include the stripping and stockpiling of all acceptable topsoil encountered within the areas to be excavated for trenches, tree pits, plant pits, and planting beds.

D. Container Removal
1. Cut containers on two sides with an acceptable cutter. Do not cut containers with spade or ax. Do not injure the rootball.
2. Carefully remove plants from containers without injury or damage to rootball.
3. After removing plants, superficially cut edge roots with knife on three sides.
4. For plants with sensitive roots, place container intact in flat pit 1½ times the size of a standard plant pit. Insert blades of sharp, needle-nose shears into a drain hole and cut the container bottom away. Remove bottom from pit. Follow with a cut down one side of the container from top to bottom. Repeat cut on opposite side. Fill plant pit with prepared plant pit mixture. Carefully remove the detached pieces.

E. Box Removal:
1. Remove bottom of planting boxes before planting.
2. Remove sides of box without damage to rootball after positioning plant and partially backfilling.

F. Planting Trees and Shrubs: Set container-grown stock, plumb and in center of pit or trench. Set top of rootball 2-inches above finish grade at trees, 1-inch above finish grade at shrubs, or as indicated on Contract Drawings. Do not use plant, if root system has severely kinked or circling roots, or if rootball is cracked, disturbed or broken. If root system is healthy, loosen spiraling roots and set in plant pit.

G. Planting pit shall be backfilled with the following soil conditioner and organic amendment, per cubic yard:
1. Application Rates, (FOR BID PURPOSES ONLY)as determined by contractor's soils tests:
   a. Potassium Sulfate - 0-0-50, ¼-pound
   b. Single Superphosphate - 0-20-0, ¼-pound
   c. Ammonium Sulfate - 21-0-0, ¼-pound
   d. Compost - 15% by volume
   e. Agricultural Gypsum - 1.5 pounds
   f. Good Humus - 15% by volume
2. Final amendments and rates are to be determined by Agronomic Soils Test.

H. When set, place additional fill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 1/2-full, place appropriate number of fertilizer tablets and complete backfill operations.

I. After backfilling, an earthen basin shall be constructed around each plant. Each basin shall be as indicated on the Contract Drawings. Basin shall be of a size suitable for the individual plant. In no case shall the basin for fifteen (15) gallon plant be less than four (4) feet in diameter; a five (5) gallon plant less than three (3) feet in diameter. The basins shall be constructed of amended backfill materials, and shall not be constructed for trees in turf areas.

J. Repeat watering until no more is absorbed.

K. Apply pre-emergent herbicide as per manufacturer's recommendations to all shrub and ground cover planting areas after planting.

L. Mulch all planted areas that do not receive jute netting, other than lawn areas, at not less than 3" thickness of mulch.
   1. Areas with 30% slope and greater shall be protected with jute mesh.

M. Equally space and align trees and shrubs in both directions where designated on Contract Drawings.

N. Pull bark mulch three (3) inches away from the rootballs of all plants to insure proper air circulation.

O. Prune, thin out and shape trees and shrubs in accordance with standard horticultural practices. Prune trees and other plantings only if required. Pruning shall be limited to remove injured wigs and branches, and to compensate for loss of roots during transplanting, but never exceed 1/3 of the branch structure. Never prune without prior review with Architect.

P. Prune shrubs to retain natural character. Unless directed by the Architect, do not prune leaders or apices of any plant material. Do not prune into balled or boxed forms without prior written approval of the Architect.

Q. Remove and replace excessively pruned or malformed stock resulting from improper pruning.

R. Planting Ground Cover
   1. Space plants as shown or scheduled.
   2. Dig holes large enough to allow for spreading of roots and compact area around plant. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.
   3. Mulch areas between ground cover plants with not less than three (3) inch deep mulch.

S. Miscellaneous Landscape Work: Install headers and edgings where shown. See appropriate details.

T. Planting Vines: Plant in accordance with details. Attach vine to vertical elements with vine ties as per manufacturer's recommendations.

U. Tree Staking and Guying: Stake or guy all trees per landscape details, and tie with tree ties as specified. Remove all nursery stakes from trees unless directed otherwise by the Architect. Immediately after planting, stake and guy all trees in accordance with details indicated on Contract Drawings. One tree of each size shall be staked and guyed, and reviewed by Architect prior to continue work.

V. Hardpan Conditions
   1. Where hardpan exists, whether it is in the form of caliche, rock or other impervious matter, and it is within the top 2½ feet of soil, or within the plant pit, use powered equipment to break through completely at each plant location to allow drainage and root growth. Remove hardpan at least 1½ feet greater than the rootball diameter of plant. Backfill with soil mix as specified.
   2. Where hardpan is within the first 12-inches of soil, it shall be completely penetrated for all trees and shrubs.

3.09 CLEANUP AND PROTECTION:

A. During landscape work, keep pavements clean and work area in an orderly condition. Haul away and remove all debris from landscape areas, and do not leave any clippings, and or other material from landscape planting and/or maintenance period.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and/or other trades. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

C. Powerwash all pavement and flatwork as necessary to remove all staining and tire marks and provide a clean surface.

3.10 FINAL REVIEW & ACCEPTANCE

A. General: Notify Landscape Architect at least 5 days in advance when requesting on-site reviews.

B. Final Site Observation requirements:
   1. Punch list at substantial completion.
   2. Final review of grading, irrigation and planting (to begin Maintenance Period).
   3. Final acceptance of project (at end of Maintenance Period).
   4. Refer to Division 32 Section "Landscape Maintenance."
   5. The maintenance period will not begin until all punchlist items are resolved and acceptance is provided by the architect in writing.
   6. Replace non-compliant and/or rejected work prior to final observation.
   7. Prior to the date of final observation, Conractor sahll provide the Landdscape Architect with all Record Drawings in accordance with the Plans and Specifications.

3.11 REPLACEMENT

A. All plant material and other materials installed under the Contract shall be waranteed against any and all poor, inadequate or inferior materials and/or workmanship or improper maintenance, as determined by the Landscape Architect, and shall be replaced by the Contractor at his expense. Warranty periods are noted in Part of this Specification.
   1. Trees, vines, and shrubs: One Year
   2. Groundcover and Turf: One Year
   3. Replacement: Any materials found to be dead, missing, or not in a satisfactory or healthy condition during the maintenance period shall be replaced immediately. The Landscape Architect shall be sole judge as to the condition of material. Material to be replaced within the guarantee period shall be replaced by the Contractor within five (5) days of written notification by the Landscape Architect. All replacement materials and installations shall comply with the Plans and Specifications.
      a. As soon as weather condtions permit, replace work that does not comply with the Plans and Specifications, without cost to the Owner. Remove rejected and non-compliant work and mateirals immediately from the project. Continue specified maintenance period until reinspected by the Landscape Architect and dtermeined to be acceptable.
      b. Any plant missing due to suspected theft shall be replaced by the Contractor. If the Contractor suspects that theft may be a problem, the Contractor shall provide written documentation to the Landscape Architect that security on this site needs to be intensified.
   4. Contractor to schedule replacement work with the Owner's representative, and arrange for proper staging and access.
      a. Contractor to include re-inspaection dats as part of replacment work scheduling.
   5. The Contractor may relieve himself of theft responsibility if after the security notice, with no result, a written notice to the Landscape Architect shall be given that plant material will not be replaced for theft or vandalism due to lack of site security being maintained. This

procedure may take place only during the Landscape Maintenance Period.

END OF SECTION 329300

SECTION 334211
STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gravity-flow, nonpressure site stormwater drainage piping.

B. Stormwater pipe accessories.

1.02 RELATED REQUIREMENTS

A. Project Geotechnical Report.

1.03 REFERENCE STANDARDS

A. AASHTO M 252 - Standard Specification for Corrugated Polyethylene Pipe, 75- to 250-mm (3- to 10-in.) Diameter; 2024.

B. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter; 2021.

C. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

D. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2020.

E. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2021.

F. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

G. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials; 2021.

H. Standard Specifications for Public Works Construction (Greenbook); current edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories, and other drain components as indicated.

C. Field Quality Control Submittals: Document results of field quality control testing.

D. Project Record Documents:
   1. Record location of pipe runs, connections, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to the requirements indicated:

1. Notify OWNER'S REPRESENTATIVE not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without OWNER'S REPRESENTATIVE written permission.

PART 2 PRODUCTS

2.01 **STORM DRAINAGE PIPE MATERIALS**

A. Plastic Pipe: ASTM D3034, Type PSM, SDR 35 Poly Vinyl Chloride (PVC) material; inside nominal diameter of 4-10 inches, bell and spigot style gasketed sealed joint ends.

B. Plastic Pipe: ASTM D3350, High Density Polyethylene (HDPE) corrugated wall pipe with integrally formed smooth liner; inside nominal diameter of 12-60 inch, meeting the requirements of AASHTO M 294, Type S, water-tight, bell and spigot joints with rubber gaskets, with pipe and fittings manufactured from virgin PE compounds with cell classification 3254420C.

C. Cast in Place Concrete: Greenbook Section 201-1.

2.02 PIPE ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

B. Geotextile Fabric: Non-biodegradable, woven [Mirafi] ;[140N]manufactured by[Mirafi].

C. Detectable Warning Tape: Install detectable warning tape during the installation of proposed utilities on contract drawings. Acid- and alakli-resistant, polyethylene film warning tape manufactured for making and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 5 mils (0.1mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep, colored as follows:
   1. Green: Storm drainage systems.
   2. Imprinted with "CAUTION BURIED STORM DRAIN LINE BELOW" in large letters.

2.03 BEDDING AND COVER MATERIALS

A. Bedding Material: As specified in Project Geotechnical Report, and contract drawings.

B. Cover Material: As specified in Project Geotechnical Report, and contract drawings.

PART 3 EXECUTION

3.01 **EXAMINATION**

A. Prior to beginning work, verify that building service connection and municipal and site utility water main size, location, and invert are as indicated.

3.02 TRENCHING

A. See Project Geotechnical Report for additional requirements.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Cut trenches wide enough to allow inspection of installed utilities.

F. Hand trim excavation for accurate placement of pipe to elevations indicated.

G. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard measured by volume.

I. Remove excess excavated material and material that is unsuitable for re-use from site.

J. Stockpile excavated material to be re-used in area designated on site.

K. Provide temporary means and methods, as required, to remove all water from trenching. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

L. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

3.03 INSTALLATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
   1. Plastic Pipe: Also comply with ASTM D2321.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building storm drainage system, foundation drainage system, and utility/municipal system.

E. Install continuous detectable warning tape 12 inches above top of pipe.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 014000 - Quality Requirements.

B. Do not enclose, cover, or put into service before inspection and approval.

C. Tests: Upon completion of this portion of the work, and prior to acceptance by the owner, perform all required tests and secure approvals from agencies having jurisdiction.
   1. Submit separate reports for each system inspection and test.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5% of internal piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leaking into piping.
      e. Exfiltration: Water leakage from or around piping.
      f. Leaks and loss in test pressure constitute defects that must be repaired.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.
   5. PVC Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test according to requirements set forth in ASTM F 1417.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 334211