CITY OF CORCORAN

DEPARTMENT OF PUBLIC WORKS

TECHNICAL SPECIFICATIONS FOR

Water Treatment Plant Storm Water Basin Relocation

Prepared by:

A&M Consulting Engineers

June 2023

CITY OF CORCORAN
DEPARTMENT OF PUBLIC WORKS

Water Treatment Plant Storm Water Basin Relocation

TECHNICAL SPECIFICATIONS

DIVISIONS AND SECTIONS

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The work embraced herein shall be done in accordance with the Standard Specifications dated 2018, and the Standard Plans dated 2018, of the Department of Transportation and any amendments insofar as the same may apply, 2018 Public Works “Greenbook” and these special provisions. In case of conflict between the Standard Specifications, Greenbook and these special provisions, the special provisions shall take precedence over and be used in lieu of the conflicting portions.

CITY OF CORCORAN
DEPARTMENT OF PUBLIC WORKS

Water Treatment Plant Storm Water Basin Relocation

TECHNICAL SPECIFICATIONS

DIVISIONS AND SECTIONS

Prepared by Certification:

In accordance with the provisions of Section 6735 of the Business and Professions Code of the State of California, these specifications have been prepared by or under the direction of the following Civil Engineer, licensed in the State of California.

A&M CONSULTIGN ENGINEERS, INC.
220 NORTH LOCUST STREET
VISALIA, CA 93291

559-429-4747

Water Treatment Plant Storm Water Basin Relocation
2023

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work required but not shown.
4. Governing documents, codes, and standards.
5. Conflicts/Clarifications
6. Access to site.
7. Work restrictions.
8. Specification and drawing conventions.

1.3 PROJECT INFORMATION

A. Project Identification: Water Treatment Plant Storm Water Basin Relocation

1. Project Location: 510 Orange Ave, Corcoran, CA 93212

B. Owner:

1. City of Corcoran
2. Public Works Director, Joseph Faulkner.

C. Project Engineer:

1. A&M Consulting Engineers
   Orfil Muniz, PE
   220 North Locust Street Visalia, CA 93291

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Relocation of a existing stormwater basin:

a. Drainage & Grading
b. Paving
c. Soil Preparation/Finish Grading
d. Stormwater infrastructure

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 WORK REQUIRED BUT NOT SHOWN

A. The following items not shown on the drawings and/or described in the specifications shall be done by the Contractor and are included in the General Scope of the Work:

1. Contractor shall coordinate locations of all piping, electrical work and other items required to be installed in overhead, wall or room spaces. Carefully study all drawings, and request permission for sleeves, cutouts, etc., wherever required for proper installation and clearances.
2. Provide drawings showing vertical sections through building wherever required to assure that overhead clearances will not be impaired. These requirements shall apply both to subcontracted and assigned work. Impairment of clearances in equipment rooms and similar spaces will not be permitted.
3. Provide coordination drawings, plans and sections as necessary, showing the relationships between the structure and the systems to be installed. Ensure routing of the services is coordinated and that the routings are not in conflict with each other.

1.6 GOVERNING DOCUMENTS, CODES, AND STANDARDS

A. All work shall be done in strict accordance with:

1. The Contract.
2. The Drawings and Specifications.
3. The Project Manual.
4. Change Orders issued by the Owner.
5. The governing Building Code(s), all governing laws, ordinances, rules, permits, regulations and directives from governing authorities having jurisdiction over this work.
6. The approved construction time and sequence schedule.
7. Guarantees, warranties, and bonds in accordance with requirements of the Contract Documents, with period of coverage as stated herein; except that if Contractor neglects to correct or complete work in final inspection check lists, during period of guarantee, Contractor shall still be responsible and required to do so after expiration dates of guarantee, until the corrective work is completed and accepted by the Owner.

1.7 CONFLICTS/CLARIFICATIONS

A. Contract Drawings and Specifications

1. Relationship of Drawings and Specifications:

a. The Drawings and Specifications taken together are the Contract Documents for this project. In the case of a discrepancy between the two, the more stringent will apply.
b. The Drawings and Specifications are meant to be supplementary and complementary to each other.

1) That which is shown on the Drawings but not shown in the Specifications shall be provided the same as if shown in both places and to the same standard of quality as for similar items.
2) That which is shown in the Specifications but not shown on the Drawings shall be provided the same as if shown in both places and to the same extent as for similar items.
3) Drawings show extent, location, dimension, relationship among various parts, and quantity of items.
4) Specifications show quality, trade names, generic names and workmanship standards.

2. Specifications:

a. The Specifications consist of several parts, which are intended to complement each other so that when taken together they provide the complete project requirements.
b. All parts shown in the Contents together with Addenda, Construction Change Directives, Proposal Requests, Approved Change Orders, Executed Contracts, and Bonds comprise the Contract Documents.
c. Each Section of the Specification includes all parts of Division 00- Bidding and Contract Documents (including Contract Forms) and of Division 01 - General Requirements, as though written in full within each Section.
d. Titles and headings to the Divisions and Sections conform to the CSI format and are introduced for convenience and shall not be taken as a complete or correct segregation of the several units of work.
e. Specifications are of the abbreviated type and include incomplete sentences; all instructions are directed to the Contractor even though such phrases as “the Contractor shall,” or “shall be done by the Contractor” have been omitted.
f. Terms such as “directed,” “required,” “selected,” “permitted,” “approved,” “acceptable,” “satisfactory,” and the like mean by the Architect, unless otherwise indicated.
g. Terms such as “shown,” “indicated,” “detailed,” and the like mean upon the Drawings.
h. The terms “provide” or “furnish” mean complete and in place.
i. The Scope paragraph, or similar paragraphs that describe the work, in each Section is intended to serve as an index of those items specified within the Section, as a locator for those items which are similar or are interfaces as specified elsewhere, and as a

reminder of the inclusion of requirements of Division 00- Bidding and Contract Requirement (including Contract Forms) and of Division 01- General Requirement; the index may not be complete; all products, equipment and labor necessary for a complete, safe and operating project are implied if not fully mentioned.

B. Conflicts/Clarifications

1. When conflicts occur that the Contractor is aware of in the Drawings (i.e. structural versus architectural) or Drawings and Specifications (i.e. Roof Detail versus Specifications) NONE of the above governs. The Contractor shall notify the Engineer PRIOR TO PROCEEDING and the Engineer will determine which way to proceed. IN EITHER CASE, IT WILL BE ASSUMED THE CONTRACTOR BID THE MORE EXPENSIVE METHOD.

2. When conflicts occur that are not brought to the Engineer's attention, the following shall govern:

   a. Addenda or modifications of any nature, to the Drawings and Specifications, take precedent over the original.
   b. In the case of a discrepancy between the Specifications and the Drawings the more stringent requirement will apply.
   c. Within the Working Drawings, the larger scale takes precedence over smaller and noted materials over graphic indications.

C. See also **GENERAL PROVISIONS** for additional information and requirements.

1.8 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to normal business working hours of 7:30 a.m. to 4:30 p.m., Monday through Friday, excluding City holidays.

1. Hours for Utility Shutdowns: 7:30 AM to 2:30 PM.
2. Hours for Core Drilling and other noisy activities: 7:30 AM to 4:00 PM.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Construction Manager & Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Construction Manager's & Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner, Construction Manager, & adjacent residents not less than two days in advance of proposed disruptive operations.
2. Obtain Construction Manager's & Owner's written permission before proceeding with disruptive operations.

E. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Provisions of the Contract Section 1-1.3, EQUALS AND APPROVALS and Section 4-1.6, TRADE NAMES OR EQUALS apply to this section with regard to substitutions made after Notice to Proceed.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

B. Action Submittals: Written and graphic information and physical samples that require Engineer's and City Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

C. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's and City Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

D. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

E. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with

requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Engineer will notify Contractor through City Engineer of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Requested substitution provides sustainable design characteristics that specified product provided.
   c. Substitution request is fully documented and properly submitted.

d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 0

SECTION 01 71 13
MOBILIZATION, SITE MAINTENANCE, DEMOBILIZATION

PART 1 - GENERAL

1.1 GENERAL

Mobilization, site maintenance, and demobilization consists of moving in and establishing the work zones, establishing health and safety procedures, performing site maintenance and cleanup, and moving out of the work site.

2.2 PERMITS

Obtain all licenses and permits. Coordinate obtaining permits with City, as necessary.

3.3 FENCING

Install any temporary fencing on the locations as deemed necessary by the City or the Contractor for site security.

4.4 NOTIFICATION FOR PROPERTY OWNERS AND TENANTS

The Contractor shall furnish all affected property owners and/or residents and merchants written notification that describes the proposed work. The notices shall include relevant dates and describe anticipated impacts to property owners during the work, including, but not limited to, a description of landscaping and improvements that may be affected and/or removed and a statement that the owners/residents have a right to salvage all such existing landscaping, improvements and/or materials that the Contractor may remove to facilitate construction within the right-of-way. The content, format, and method of delivery of such notices shall be approved by the Engineer prior to distribution. The Contractor is advised that these notices shall not be placed in mailboxes, as it is a violation of federal postal regulations. Affected property owners and residents or merchants shall be considered all those who:

a. Front on or are contiguous to the Project limits.

b. Have ingress/egress route only from within the Project limits.

The Contractor shall provide approved notification to all affected owners/residents a minimum of **ten (10) CALENDAR DAYS** prior to the commencement of any Project site work. Failure to distribute notices shall be sufficient cause for the Engineer to suspend the work until such notices are distributed.

5.5 WORK ZONES

Establish exclusion, decontamination, and clean zones at the Site, using temporary chain link fence, traffic barricades, caution tape, or other appropriate method.

6.6 RUBBISH AND TRASH

Collect rubbish and trash daily. Do not allow rubbish and trash to collect such that a safety or fire hazard exists or nuisance or bad appearance.

7.7 SITE MAINTENANCE

Promptly decontaminate and remove materials or equipment that have served their use on the Site. At the end of each day, perform the following:

c. Secure the site;
d. Store equipment and materials in locations approved by City;
e. Disconnect water and power (except as needed for health and safety and security.)

8.8 FINAL CLEANUP AND DEMOBILIZATION

f. Upon completion of the Work, decontaminate (if necessary) and remove all materials and equipment brought to the Site.

g. Leave the Site clear of all debris, including thoroughly sweeping all paved areas.

h. Remove any temporary fencing that was installed.

i. Repair any damage to fences, buildings, streets, parking lots, curbs, landscaping, and other property caused by Contractor's activities.

j. Decontaminate all equipment, vehicles, or other items prior to removal from the Site.

PART 2 - PRODUCTS
NOT USED

PART 3 - EXECUTION
NOT USED

-END OF SECTION

SECTION 01 31 00 –
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
2. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, City Engineer, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper

installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Engineer and City Engineer.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
1. Contractor's suggested resolution. If Contractor's suggested resolution impacts the

Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

2. Contractor's signature.
3. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

B. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Engineer.

    1. Attachments shall be electronic files in Adobe Acrobat PDF format.

C. Engineer's and City Engineer's Action: Engineer and City Engineer will review each RFI, determine action required, and respond. Allow seven working days for Engineer's response for each RFI. RFIs received by Engineer or City Engineer after 1:00 p.m. will be considered as received the following working day.

    1. The following Contractor-generated RFIs will be returned without action:

        a. Requests for approval of submittals.
        b. Requests for approval of substitutions.
        c. Requests for approval of Contractor's means and methods.
        d. Requests for coordination information already indicated in the Contract Documents.
        e. Requests for adjustments in the Contract Time or the Contract Sum.
        f. Requests for interpretation of Engineer's actions on submittals.
        g. Incomplete RFIs or inaccurately prepared RFIs.

    2. Engineer's action may include a request for additional.

information, in which case Engineer's time for response will date from time of receipt of additional information.

3. Engineers's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Project Engineer and City Engineer in writing within 10 days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Engineer and City Engineer.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.

11. Date Project Engineer's and City Engineer's response was received.

C. On receipt of Project Engineer's and City Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer and City Engineer within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: City Engineer will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant

discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, City Engineer, and Project Engineer, within three days of the meeting.

B. Preconstruction Conference: City Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Project Engineer, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, City Engineer, Project Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Lines of communications.
f. Procedures for processing field decisions and Change Orders.
g. Procedures for RFIs.
h. Procedures for testing and inspecting.
i. Procedures for processing Applications for Payment.
j. Distribution of the Contract Documents.
k. Submittal procedures.
l. Preparation of record documents.
m. Use of the premises.
n. Work restrictions.
o. Working hours.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Procedures for disruptions and shutdowns.
s. Construction waste management and recycling.
t. Parking availability.
u. Office, work, and storage areas.
v. Equipment deliveries and priorities.
w. First aid.
x. Security.
y. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer, City Engineer of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility requirements.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written instructions.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: City Engineer will schedule and conduct a project

closeout conference, at a time convenient to Owner and Engineer, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, City Engineer, Engineer, 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. Requirements for preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: City Engineer will conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, City Engineer, and Project Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 33 00
SUBMITTALS PROCEDURES

PART 1 - GENERAL

1.1 STANDARD SPECIFICATIONS:

The provisions of the Standard Specifications shall apply, except as modified herein.

1.2 SCOPE:

The Work of this Section shall consist of furnishing all labor, materials, equipment, appliances, and services necessary for the execution and completion of all Submittals Work as shown on the Plans and as described in the Specifications including, but not necessarily limited to, the following:

- Preparation of Submittals Schedule; Submittals Planning;
- Submittals Preparation, Distribution and Transmittal, to include all of the following:
    - Existing static water pressure tests and meter size verification; Dig Alert compliance and Site investigation certification; Materials Lists;
    - Product Data (Catalog Cuts); Material Samples;
    - Record Drawings;
    - Submittals Schedule updating and distribution;

1.3 RELATED WORK:

Shop Drawing Submittals

Contractor's Construction Schedule- Updated and revised as required;

1.4 SUBMITTAL PLANNING:

A. Processing Lead Time: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow **two (2)** weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Construction Manager will promptly advise Contractor when a submittal being processed must be delayed for coordination.

2. If a resubmittal is necessary due to corrections or revisions, process the resubmittal in the same manner as the initial submittal.

3. Allow **two (2)** weeks for processing each resubmittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Construction Manager sufficiently in advance of the Work to provide

the two-week processing time specified.

1.5 Coordination and Completeness:

1. Contractor shall coordinate preparation and processing of submittals with the performance of the related Work. Transmit each submittal allowing sufficient lead time to obtain appropriate reviews and approvals and to avoid delays in the related Work.

2. Coordinate the submittal date for each submittal with the lead time needed for fabrication, purchasing, testing, delivery, review of other related submittals, and related Work that require sequential processing/completion.

3. Coordinate the transmittal dates for each different type of submittal so processing will not be delayed. Ensure concurrent transmittal of submittals for related portions of the Work that need concurrent review to allow the Engineer to verify that a coordinated work effort is being provided. City and Engineer each reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

4. Contractor is responsible to verify completeness of all submittals. Incomplete submittals will be rejected.

1.6 ELECTRONIC SUBMITTAL:

Electronic Procedures Summary

- Shop drawing and product data submittals shall be transmitted to Engineer in electronic (PDF) format.

- The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.

- The electronic submittal process is not intended for color samples, color charts, or physical material samples.

Procedures:

Submittal Preparation - Contractor may use any or all of the following options:

- Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via email.
- Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
- Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.

Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions

and coordination of information with other parts of the work.

Contractor shall transmit each submittal to Engineer.

Architect / Engineer review comments will be made available.

Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.

Submit paper copies of reviewed submittals at project closeout for record purposes at project closeout.

1.7 Submittal Schedule:

Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Name of subcontractor.
    d. Description of the Work covered.
    e. Scheduled date for Architect's and Construction Manager's final release or approval.
    f. Scheduled date of fabrication.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.
    i. Activity or event number.

Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 workdays for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect or Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.

    a. Engineer and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 workdays for review of each resubmittal.

B. Transmittal Form for Electronic Submittals: File name shall use project Specification Section number followed by a decimal point and then a sequential number (061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g.,061000.01.A). Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:

1. Project name.
2. Date.
3. Name and address of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Specification Section number and title.
11. Specification paragraph number or drawing designation and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Location(s) where product is to be installed, as appropriate.
14. Related physical samples submitted directly.
15. Indication of full or partial submittal.
16. Transmittal number, numbered consecutively.
17. Submittal and transmittal distribution record.
18. Other necessary identification.
19. Remarks.
20. Deviations and Additional Information:

a. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

1.8 RFI'S:

Contractor shall submit Request for Information (RFIs) via Submittal Exchange upon immediate discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the format acceptable by the Construction Manager.

A. Engineer will return RFIs submitted by other entities controlled by Contractor with no response.
B. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
C. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Engineer and Construction Manager.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's physical or digital signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

1.9 SAMPLES:

General: Submit full-size, fully fabricated Samples cured and finished as specified, in the quantity specified in the respective Technical Specification section, and physically identical with the material or product proposed. Where quantities are not specified in the Technical Specification, submit a minimum of three samples, one will be returned marked with the action taken. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.

1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples Submittals to match the Architect's Sample when

available. Include the following:

a) Generic description of the Sample.

b) Sample source.

c) Product name or name of manufacturer.

d) Certification of compliance with the specified standards.

e) Availability and delivery time.

2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.

3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product. Preliminary submittals will be reviewed and returned with the appropriate Designer's mark indicating selection and other action.

4. Maintain appropriately marked sets of Samples, as returned by City, at the Project site for quality comparisons throughout the course of construction.

Distribution of Samples: If additional sets of samples are needed for distribution to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work, Contractor shall submit samples in sufficient quantities for such distribution. Do not distribute unmarked copies of sample to others involved in the Work.

1.10 MATERIALS LISTS:

A. Submittal Requirements: Submitting a catalog number and manufacturer's name as a materials list stating that the items will be furnished to meet the Specifications will not be acceptable. Contractor shall submit a complete materials list for approval by The Construction Manager prior to performing any Work. Catalog data and full descriptive literature must be submitted whenever the use of items different than those specified is requested. Notarized certificate must be submitted by plastic pipe and fitting manufacturer indicating that material complies with the Project Specifications, unless material has been previously approved and used on other projects by City.

Material list shall be submitted in a format similar to the following:

Item	Description	Manufacturer	Model No.
1.	Pressure Supply Line	Lasco	Sch. 40
2.	Lawn Head	Rainbird	2400
etc.	etc.	etc.	etc.

1.11 "RECORD" PRINTS:

A. Changes: Record accurately on one set of blue-line prints all changes in the Work constituting departures from the original Contract Plans.

B. Legibility and Approval: The changes and dimensions shall be recorded in a legible and workmanlike manner to the satisfaction of City. Prior to final inspection of the Work, submit "record" prints to The Construction Manager for approval.

C. Reference Points: Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Data to be shown on "record" prints shall be recorded day-to-day as the project is being installed.

D. As-built Items: Show locations and depths of the following types of underground items:

1. Stormwater pipes

E. Maintain record prints on site at all times.

1.12 SOIL REPORTS:

A. Submittal:

Contractor to furnish reports after the completion of Fine Grading and sampling at various locations directed by City Representative. Testing and reports shall be by an accredited lab.

1.13 DIG ALERT COMPLIANCE AND SITE INVESTIGATION VERIFIACTION:

A. Submittal:

Contractor to submit and keep active Tickets open with 'DIG Alert' throughout the duration of the project. Contractor to print out all tickets and updates/renewals and submit copies upon start and monthly thereafter. Any lapse in active DIG Alert tickets resulting in any damages will be the sole responsibility of the contractor. Contractor to also Verify in a written report all steps taken to investigate the site for existing buried utilities and or other underground structures that may be present. Contractor to list all visible structures that can be seen/assumed to have or be serviced by underground utilities and or structures and what steps were taken to investigate possible utilities and locations. Any failure by the Contractor to complete this required due diligence and resulting damages will be the sole responsibility of said Contractor.

PART 2 - MATERIALS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

-END OF SECTION-

SECTION 01 40 00 –
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, City Engineer, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. 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.

B. 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. Services do not include contract enforcement activities performed by Engineer or City Engineer.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or

quality levels comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer’s for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum

C. within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality- assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor- elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the

system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. 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.

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

J. 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 responsibilities include the following:

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. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection,

and similar quality-assurance service to Engineer, through City Engineer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.9 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation,

including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

C. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Engineer, City Engineer, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Engineer, City Engineer, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-

assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Engineer, City Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency and/or special inspector 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 reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Engineer, City Engineer, 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 Engineer, through City Engineer, 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

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted. Description of the Work tested or inspected.

2.

Date test or inspection results were transmitted to Engineer.

Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's and City Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 50 00 –
TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 32 12 16 "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
3. Section 32 13 13 "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Engineer, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire- prevention program.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high 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 rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high 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 galvanized-steel bases for supporting posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

2.2 TEMPORARY FACILITIES

A. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install temporary electric power service overhead unless otherwise indicated.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

   1. Provide construction for temporary shops and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   2. Maintain support facilities until city inspector schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

   1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

   1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
   2. Prepare subgrade and install subbase and base for temporary roads and paved areas.
   3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 12 16 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

   1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to the SWPPP Site Plan.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.

4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in Section 01 56 39 "Temporary Tree and Plant Protection."

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

I. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

K. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and

similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 56 39 –
TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 31 10 00 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line.

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

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and [indicated on Drawings] [defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated] defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches unless otherwise indicated.

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

1.4 PREINSTALLATION MEETINGS

A. 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. Tree-service firm's personnel and equipment needed to make progress and avoid delays.

b. Arborist's responsibilities.
c. Quality-control program.
d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones.
f. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of trenching by hand or with air spade within protection zones.

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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. 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.

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

D. 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 video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA.

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. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Soil: Planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
1. Planting Soil: Planting soil as specified in Section 32 91 15 "Soil Preparation (Performance Specification)."

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: Ground or shredded bark.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.

a. Height: 48 inches.
b. Color: High-visibility orange, nonfading.

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

1. Lettering: 3-inch-high minimum, black characters on white background.

PART 3 - EXECUTION

3.1 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. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue vinyl tape around each tree trunk at 54 inches 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. Do not exceed indicated thickness of mulch.

1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not

place mulch within 6 inches of tree trunks.

3.3 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 areas 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 Engineer.
3. Access Gates: Install where necessary; 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 Engineer. Install one sign spaced approximately every 35 feet 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. Maintain protection-zone fencing and signage in good condition as acceptable to Engineer 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.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 20 00 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

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 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.

3.5 ROOT PRUNING

A. Prune tree 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: As directed and recommended 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 Section 31 20 00 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

B. Unless otherwise directed by arborist and acceptable to Engineer, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

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

3.7 REGRADING

A. 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.

B. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 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.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Engineer.
1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full- growth status, as determined by Engineer.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Engineer determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
2. Large Trees: Provide one new tree(s) of 6-inch caliper size for each tree being replaced that measures more than 6-inches in caliper size.

a. Species: As selected by Engineer.

3. Plant and maintain new trees as specified in Section 32 93 00 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch uniform thickness to remain.

D. Soil Aeration: Where directed by Engineer, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered 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 01 56 39

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

1. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information
   a. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   b. Products: List products to be used for patching and firms or entities that will

perform patching work.

c. Dates: Indicate when cutting and patching will be performed.

d. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

e. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.
b. Fire-suppression systems.
c. Control systems.
d. Communication systems.
e. Conveying systems.
f. Electrical wiring systems.
g. Operating systems of special construction.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.
B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

C. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

D. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

E. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to

fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer and Construction Manager promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Engineer and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer and Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Contractor shall identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks

and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging

operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
2. Allow for movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage.

Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
    a. Remove liquid spills promptly.
    b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

C. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

D. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

F. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to assure that no part of the

construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 02 41 19 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
2. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

a. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Concrete masonry units.
e. Electrical conduit.
f. Copper wiring.
g. Lighting fixtures.
h. Lamps.
i. Ballasts.
j. Electrical devices.
k. Switchgear and panelboards.
l. Transformers.
m. Wood fence.
n. Tubular steel fence.
o. Utility poles

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Piping.
g. Electrical conduit.
h. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
    1) Paper.
    2) Cardboard.
    3) Boxes.
    4) Plastic sheet and film.
    5) Polystyrene packaging.
    6) Wood crates.

1.5 Plastic pails.

ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during

the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Review locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area off-site designated by Owner.
5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum

contamination, and other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

C. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 01 74 19

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 01 73 00 "Execution" for progress cleaning of Project site.
2. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.5 Field Report: For pest control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in

other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by City Engineer. Label with manufacturer's name and model number where applicable.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
7. Complete final cleaning requirements, including touchup painting.
8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and City Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate

will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.8 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
3. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer and City Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: 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.

1. Organize list of spaces in sequential order.
2. Include the following information at the top of each page:
    a. Project name.
    b. Date.
    c. Name of Engineer and City Engineer.
    d. Name of Contractor.
    e. Page number.

3. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Engineer, through City Engineer, will return annotated file.
    b. PDF electronic file. Engineer, through City Engineer, will return annotated file.

1.10 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose- leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs and bulbs noticeably dimmed by hours of use.

END OF SECTION 01 77 00

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01 73 00 "Execution" for certified survey.
2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and one of file prints.
2) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
1) Submit PDF electronic files of scanned record prints and one set(s) of prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

C. Reports: Submit written report weekly indicating items incorporated into project record

documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued. Records shall be kept up to date with all entries checked by the Engineer before the Work is buried or covered up. The Contractor shall make the Record Drawings available for review by the Engineer at any time.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Locations and depths of underground utilities.
    d. Revisions to routing of piping and conduits.
    e. Revisions to electrical circuitry.
    f. Actual equipment locations.
    g. Changes made by Change Order or Construction Change Directive.
    h. Changes made following Engineer's written orders.
    i. Details not on the original Contract Drawings.
    j. Field records for variable and concealed conditions.
    k. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer and City Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Engineer through City Engineer for resolution.
4. Engineer will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

    a. See Section 01 33 00 "Submittal Procedures" for requirements related to use of Engineer's digital data files.
    b. Engineer will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Engineer and City Engineer.
    e. Name of Contractor.

2.2 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record

documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's and City Engineer's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 78 40
WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

1. Compile specified warranties and bonds.
2. Compile specified service and maintenance contracts.
3. Co-execute submittals when so specified.
4. Review submittals to verify compliance with Contract Documents.
5. Submit the above to the Owner for review.
6. Refer to the General Conditions for General Warranty of Construction.
7. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.2 DESCRIPTION

A. Work under this Contract shall be warranted by the Contractor against all defects for a minimum of one (1) year from the Date of Substantial Completion of the Work or designated portions thereof or for a minimum of one (1) year after acceptance by the Owner of designated equipment. In case of items remaining uncompleted after Date of Substantial Completion, the one-year warranty period shall run from the date of acceptance of such items. Special warranties applicable to definite parts of the Work and as specifically stipulated in the separate Sections of the Specifications or other Contract Documents shall be subject to the terms of this Paragraph during the first year of the life of such warranty. If repairs or changes are required in connection with the warranted Work within any warranty period, the Contractor shall, promptly upon receipt of notice from the Owner, Engineer or Architect, and without expense to the Owner, comply with the following:

1. Place in satisfactory condition in every particular all of such warranted Work and correct all defects herein.
2. Make good damage to the buildings or site, which is the result of the cause for said repairs and changes.

3. Make good any Work, including the equipment and contents of said buildings or site, disturbed in fulfilling any such warranty.

B. The Owner may, at his sole discretion, after the Contractor has received seven (7) days written notice, repair or cause to be repaired special equipment which he has caused to be furnished and installed and which may be damaged and the repair of which is included in the provision of any warranty; however, where special equipment is involved which, because of its inherent nature, may suffer further damage or cause loss to the Owner due to the seven day delay, the Owner may cause such to the seven day delay, the Owner may cause such equipment to be repaired without notice to the Contractor. The cost of such repairs and the reconditioning of the equipment to its exact state prior to damage.

C. If repairs or changes are required in connection with warranted Work within any warranty period and notice thereof is given within such period, the warranty shall continue as to Work requiring repair or change until the things herein required to be done are completed, and the termination of the warranty period shall not apply thereto.

D. In case of Work performed by Subcontractors and where special warranties are required, warranties addressed to and in favor of the Owner shall be secured from said Subcontractors.

E. No provision in the Contract Documents nor in any special or general warranty shall be held to limit, as to time or scope of liability, the Contractor's liability for defects, or the liability of his sureties, to less than the legal limit of liability under laws having jurisdiction.

F. The Contractor will not be held responsible for defects due to misuse, negligence, willful damage, improper maintenance, or accident caused by others, nor shall he be responsible for parts whose replacement is necessitated by failure of the Owner's maintenance forces to properly clean and service them provided that the Contractor has furnished complete maintenance instructions to the Owner.

G. Submit warranties to Engineer or Architect for review and transmittal to Owner.

H. The delivery of any warranties shall not relieve the Contractor from any obligation assumed under any other provision of the Contract Documents.

I. The obligations of the Contractor, under this Section, shall survive termination of the Contract.

J. Some work may require warranties for more than one (1) year.

1.3 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

F. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

A. General:
   1. Submit written warranties, bonds, and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors to the Owner.
   2. For equipment or component parts of equipment put into service during progress of construction, submit documents within 10 days after inspection and acceptance.
   3. For all other items, submit at closeout.
   4. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within 10 days of completion of that designated portion of the Work.
   5. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide update submittal within 10 days after acceptance, listing the date of acceptance as the start of the warranty period.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.

   1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Form of Submittal: Compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind Warranties and Bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl- covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the following:

a. Product or work item.
b. Firm, with name of principal, address and telephone number.
c. Scope.
d. Date of beginning of warranty, bond or service and maintenance contract.
e. Duration of warranty, bond or service maintenance contract.
f. Provide information on proper procedures in case of failure, and instances that might affect the validity of warranty or bond.
g. Contractor, name of responsible principal, address and telephone number.

2. Bind Warranties and Bonds in heavy-duty, commercial quality, durable 3- ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 ½" by 11" paper. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS" for (list product), the Project title or name and name of the Contractor.

3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

E. Special Guarantees are required by various sections of the Specifications. Assemble written Guarantees, label and submit to the Owner's Project Manager for review and transmittal to the Owner.

1. Equipment Guarantees shall be written in the manufacturer's standard form and shall be countersigned by the Subcontractor and Supplier and the Contractor.
2. All other Guarantees shall be written on the subcontractor's or supplier's letterhead and shall be countersigned by the Contractor.
3. Bind Guarantees in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 ½" by 11" paper. Identify each binder on the front and the spine with the typed or printed title "GUARANTEES", the Project title or name and the name of the Contractor.
4. When operating and maintenance are required for Guaranteed construction, provide additional copies of each Guarantee, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 WARRANTIES

A. Submit warranties, bonds, service and maintenance contracts as specified in the respective sections of the Specifications.

3.2 FORM OF WARRANTY

A. Warranties shall be in the form set forth below and shall be typed on the Contractor's own letterhead. Please see next page.

Following is:

Sample "Warranty For"

WARRANTY FOR _____
We hereby warrant that the _____ that we have installed in the ___ has been done in accord with the Contract Documents and that the Work as installed will fulfill the requirements of the warranty included in the Specifications.
We agree to repair or replace any or all of our Work together with any other adjacent Work which may be displaced or damaged by so doing, that may prove to be defective in its workmanship or materials within a period of _____year(s) from date of acceptance of the above-named Work, without any expense to the Owner, unusual abuse or neglect excepted.

In the event of our failure to comply with the foregoing conditions within seven (7) days after being notified in writing by the Owner, we collectively or separately do hereby authorize the Owner or its successor in interest to proceed to have said defects repaired and made good at our expense and we will honor and pay the costs and charges therefore upon demand.
Signed: _____
(Contractor)
< or >
Signed: _____(Subcontractor) Countersigned: _____(Contractor)

END OF SECTION 01 78 40

SECTION 02 41 13
SITE DEMOLITION

PART 1 - GENERAL

1. RELATED DOCUMENTS

   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. SECTION INCLUDES

   B. Demolition and removal as indicated on Drawings and as required to accommodate new work, including, but not limited to:

      1. Saw-cutting and removal of asphalt concrete, concrete paving and footings.
      2. Removal and capping of existing underground utilities.
      3. Existing selective vegetation removal
      4. Fencing/Gating and associated footings removal and/or adjustments

   C. Salvage of existing materials, products, and equipment as indicated on Drawings.

3. RELATED WORK SPECIFIED ELSEWHERE

   D. Division 31 Section "Site Clearing".

   E. Division 31 Section "Grading".

   F. Division 31 Section "Excavation and Fill for Utilities".

   G. Division 31 Section "Excavation and Fill for Structures".

   H. Division 32 Section "Asphalt Concrete Paving".

   I. Division 32 Section "Site Concrete Work".

4. PROJECT CONDITIONS

   J. Dust control:

      1. Use all means necessary to prevent spread of dust during performance of work. Thoroughly allay dust at all times.

      2. Use of reclaimed water shall conform to requirements and guidelines of governing health authorities and be specifically approved by City Representative.

   K. Burning on-site: Not permitted.

   L. Protection: Use all means necessary to protect existing objects designated to remain, including structures, utilities, flora, and trees. In the event of damage to existing objects designated to remain, repair or replace objects to satisfaction of City Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials, equipment, shoring, and appurtenances of every kind required for completion of demolition work, including barricades, handrails, and waste receptacles.

B. Explosives: Not permitted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces for conditions that will adversely affect execution, permanence, and quality of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Job site examination:

1. Prior to commencing work, examine entire job site for objects designated to be removed and protected, and limits of demolition.
2. Locate existing active utility lines and provide for their protection.

B. Clarification:

1. Drawings do not indicate all objects existing on job site.
2. Before commencing work, verify with Owner which objects are to be removed by Contractor, which objects are to be removed by Owner, and which objects are to be preserved.

C. Scheduling: Contractor to avoid interference with use of, and passage to and from, adjacent buildings and facilities. Contractor to avoid interference with use of the public sidewalk and street traveled way.

D. Protection of utilities:

1. Preserve and maintain in operating condition all active utilities traversing site. Reroute, or remove and cap those which interfere with work of this Project. Coordinate extent of work with City Representative.
2. Expeditiously repair damaged utilities at no cost to City.

E. Protection of flora:

1. Construct a physical barrier between existing flora to remain and area of new construction. See Tree Protection notes on planting plans and in specifications.
2. Protect existing trees, not otherwise indicated to be removed, against unnecessary cutting, or breaking, skinning, bruising of bark. All trees to remain are required to have a protective fence around the tree at the drip line. Smothering of trees with stockpiled building materials or excavated materials within the drip line is not allowed. Pedestrian or vehicular traffic and parking of

vehicles within drip line is not allowed.

3. Refer to Tree Protection Notes on Planting Plans.

3.3 DEMOLITION AND REMOVAL

A. Demolition and removal of materials shall be by skilled and properly equipped workers. Materials and equipment to be salvaged shall be removed under the direction of or by crafts persons who would normally install such items.

B. Cut concrete and asphalt concrete slabs, walks, pavement, and curbs with a concrete saw to a 2 inch depth along all joint lines before breaking out the portion to be removed.

C. Demolish and remove all foundations, walls, concrete slabs, asphalt concrete pavement, footings and other items designated for removal, or which are necessary to be removed to make way for new construction work.

3.4 SALVAGE

A. All materials removed shall become the property of Contractor to dispose of or salvage, with the exception of items designated on Drawings to be subsequently reinstalled or returned to City or items "tagged" as salvage for return to City and not previously removed by City.

B. Identify (tag or similarly mark indelibly in an inconspicuous location) each salvage item, including detached component parts, with an extensive description of salvage item or component part's use, installed location, date of removal, and similar pertinent information as may be required for reinstallation or future reference by City. For salvage items not reinstalled in the Work, box, package or otherwise protect, and transport to City-designated locations.

C. Dispose of all materials.

D. Do not sell salvage materials to the general public at job site. This shall not preclude sale to and removal from job site of salvage materials to duly licensed salvage companies.

E. Temporarily store removed materials for subsequent reinstallation at confined areas designated by City Representative. Carefully handle removed materials to prevent damage to areas outside immediate locations of the Work.

3.5 DISPOSAL

A. Except as specified otherwise, load debris resulting from demolition and removal as it accumulates, haul away from site promptly, and dispose of in a legal manner.

B. Prevent debris from migrating outside of construction areas. Use City-approved methods and materials to confine debris to construction areas. Failure to contain demolition debris is not permitted.

C. In lieu of disposal off-site, asphalt concrete paving debris, resulting from the work of this Project only, may be crushed for limited use as recycled fill and asphalt concrete paving base course materials as specified in Division 31 Section "Grading" and Division 32 Section "Asphalt Concrete Paving". Imported asphalt concrete debris may not be broken, crushed, or otherwise processed on-site nor added to on-site asphalt concrete paving debris. Asphalt concrete paving debris used as recycled fill and

asphalt concrete paving base course materials shall conform to SSPWC Section 200-2.4, except as follows:

1. Gradation shall conform to Fine Gradation per Table 200-2.4.2 (A).
2. Permission for on-site crushing operations is at City discretion. Where on-site crushing is permitted, conform to City noise and dust control requirements, including scheduling of crushing operations.
3. Additionally, perform tests and submit records of test results for crushed asphalt concrete paving used as recycled fill materials in accord with SSPWC Section 203-7.2.2.

- END OF SECTION-

SECTION 02 41 13.13
PAVING REMOVAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section describes the sawcutting of the existing pavement at the locations shown on the Contract Documents.

1.02 REFERENCED SECTIONS

A. Division 31 Section "Site Clearing".
B. Division 32 Section "Asphalt Concrete Paving".
C. Division 32 Section "Site Concrete Work".

CITED STANDARDS

A. Comply with the New York State Department of Transportation (NYSDOT) Standard Specifications.

NOTED RESTRICTIONS

(None noted)

QUALITY CONTROL

(None listed)

SUBMITTALS

(None listed)

DELIVERABLES

(None listed)

PART 2 - PRODUCTS

2.01 MATERIALS

None.

PART 3 - EXECUTION

3.01 METHOD

A. The Contractor shall sawcut the existing pavement with a straight sawcut edge as shown on the plans or where directed by the Engineer. All work must be done in a workman-like manner. All sawcuts shall be done in a wet condition. The Contractor shall contain and capture the slurry so as not to pollute adjacent grounds and waterways.

B. Sawcutting of sidewalk, where curbs are reconstructed, shall be required at the limits of work.

C. The depth of the sawcut shall be established from the contract plans or based on the depth necessary to properly install the proposed materials.

D. At locations where new full-depth pavement will meet existing pavement, one sawcut line is shown in the details. In addition, a second, less deep, sawcut shall be made two (2) feet beyond the indicated sawcut so that this area can be milled and tack coated. The new wearing course shall extend to this second sawcut. See details concerning meeting existing pavement in the Contract Documents for additional requirements on this item.

-END OF SECTION-

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections apply to work of this section.

1.2 DESCRIPTION OF WORK

A. The work of this section includes labor, materials, hardware, equipment, transportation and services required to fabricate and place all reinforcement for cast-in-place concrete including bars, welded wire fabric, ties and supports shown on the drawings and as specified. Prestressing reinforcement is specified in Post-Tensioned Concrete and/or Precast Concrete sections of the specifications.

1.3 ENVIRONMENTAL OBJECTIVES

A. The Owner has established environmental goals and strategies for achieving them for this project based upon the LEED® Green Building Rating System for New Construction & Major Renovations Version 2009, as developed by the U.S. Green Building Council. Refer to Division 01 Section "Sustainable Design Requirements."

B. Manufacturer to supply documentation of level of compliance or non-compliance with the following requirements before consideration as an "acceptable manufacturer:"

1. The following are mandatory requirements for the overall project:

a. The material(s) in the product(s) supplied shall have a recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes at least **6%** of the total value of the material in the project, if feasible and economical.

b. **50%** of the product(s) supplied is extracted, processed, and manufactured regionally within a radius of 500 miles of this project, if feasible and economical.

1.4 QUALITY CONTROL

A. The Contractor is responsible for management of quality control on the project, including verification of the compliance of the workmanship and materials furnished by his subcontractors and suppliers.

B. Codes and Standards: Comply with all provisions of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. ACI 301 - "Specifications for Structural Concrete for Buildings".

2. ACI 117 - 'Specifications for Tolerances for Concrete Construction and Materials."

3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

4. ANSI/AWS D1.4 “Structural Welding Code – Reinforcing Steel”

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings for all reinforcing steel and related accessories for the Engineer's approval. Shop drawings shall show arrangement and layout, bending and assembly diagrams, bar schedules, stirrup spacing, splicing of bars, laps of bars, and layout/configuration of all necessary miscellaneous support bars in accordance with CRSI Standards.

B. Mill Certificates: Submit, for record, mill certificates and/or test results signed by Contractor and Producer, for all reinforcement.

C. Product Data: Submit manufacturer’s product data with application and installation instructions for proprietary materials and items, including mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement, dowel bar substitute systems, and dowel bar sleeves.

D. International Code Council (ICC) Evaluation Service Reports: Submit evaluation service reports of approval from ICC Evaluation Service, Inc. for mechanical splice, hooked anchorage systems, large-headed stud punching shear reinforcement and dowel bar substitute systems.

E. LEED Submittals (Projects authorized for LEED certification only)

1. Recycled Content- Credit MR4.1/MR 4.2: Provide documentation indicating percentages of post-consumer and pre-consumer recycled content by weight per unit of product or assembly containing the product. Indicate the percentage of the dollar value of the recycled content compared to the total dollar value of the product or assembly containing the product.

2. Material Proximity- Credit MR 5.1/MR 5.2: Where the distance to the project site is 500 miles or less, indicate location and distance to project site of extraction, harvesting, recovery and manufacturing of all materials. Indicate the dollar value of the material cost of the product containing local/regional materials. Where product components are sourced or manufactured in separate locations, provide location and percentage by weight of each component per unit of product.

1.6 PREINSTALLATION CONFERENCE

A. The Reinforcing-Placing subcontractor shall attend the Pre-Concrete Conference conducted by the Concrete Contractor as described in Specification Section "Cast-in-Place Concrete".

1.7 TESTING AND INSPECTION

A. In advance of fabrication and shipment to the project, the fabricator shall have performed all tests and inspections of reinforcing steel as specified herein.

B. Any testing laboratory retained to run tests required by this specification shall meet the basic requirements of ASTM E 329.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcement:

1. Reinforcing materials shall be delivered from the mill in bundles that are identified as to heat number and manufacturer and accompanied with mill and analysis test reports and an affidavit from the fabricator/supplier stating that the material conforms to the requirements of the governing ASTM specification listed herein.

2. Deformed bar material that is not identifiable according to the criteria listed above shall be tested for tensile strength and bend tests according to ASTM A 615 on a sample of 2 bars for each ten tons or fraction thereof of unidentified material for each bar size. The bars shall be a minimum of 24 inches long. Bend tests are not required for #14 and # 18 bars. Fabricator/supplier shall submit the results of such tests for record.

3. Reinforcing Bars: Reinforcing bars shall conform to ASTM A 615, Grade 75 as noted on the drawings.

4. Reinforcing Bars: Reinforcing bars shall conform to ASTM A 615 Grade 60 as noted on the drawings.

5. Special Requirements for Grade 60 Reinforcing Bars: ASTM A 615 Grade 60 Reinforcing bars used as longitudinal reinforcing in locations as noted on the drawings shall additionally comply with the following requirements.

   a. The actual yield strength based on mill tests shall not exceed the nominal yield strength fy by more than 18,000 psi.
   b. The ratio of the actual tensile strength to the actual yield strength is not less than 1.25.

6. Reinforcing Bars: Reinforcing bars used as longitudinal reinforcing in locations as noted on the drawings shall conform to ASTM A 706.

7. Reinforcing Steel: Reinforcing steel used as transverse reinforcing or as spiral reinforcing as noted on the drawings shall conform to ASTM A 1035.

8. Weldable Reinforcing Bars: All reinforcing bars noted on the drawings as being required to be welded shall conform to ASTM A 706.

9. Galvanized Reinforcing Steel: Provide galvanized reinforcing bars at the locations indicated on the drawings. Galvanized reinforcing bars shall conform to ASTM A 767 Class II (2.0 oz. zinc PSF), hot dipped galvanized after fabrication and bending. Bars that are to be galvanized shall conform to the type of steel required for the given situation as noted on the drawings.

10. Epoxy-Coated Reinforcing Steel: Provide epoxy coated reinforcing bars at the locations indicated on the drawings. Epoxy coated reinforcing bars shall conform to ASTM A 775. Bars that are to be epoxy coated shall conform to the type of steel required for the given situation as noted on the drawings.

11. Epoxy-Coated Fabricated Reinforcing Steel: Provide reinforcing bars that are epoxy-coated after fabrication at the locations indicated on the drawings. Reinforcing bars that are epoxy-coated after fabrication shall conform to ASTM A 934. Bars that are to be epoxy-coated shall conform to the type of steel required for the given situation as noted on the drawings.

12. Use Reinforcing steel made from 90% recycled material, 2/3 of which shall be post-consumer material. A minimum of 50% of the material in the reinforcement must have been extracted, harvested, or recovered as well as manufactured, within 500 miles of the project site.

13. Plain Steel Welded Wire Reinforcement: ASTM A 185 with a yield strength of 65,000 PSI. Provide in flat sheets only.

14. Deformed-Steel Welded Wire Reinforcement: ASTM A 497 with a yield strength of 70,000 PSI. Provide in flat sheets only.

15. Galvanized Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from galvanized steel wire into flat sheets.

16. Epoxy Coated Plain-Steel Welded Wire Reinforcement: ASTM A 884, Class A, plain steel.

17. Epoxy Coated Deformed-Steel Welded Wire Reinforcement: ASTM A 884, Class A, deformed steel.

18. Strands: Uncoated seven wire, one half inch diameter, stress relieved 270 ksi strand low relaxation type, ASTM A 416 "Specification for Uncoated Seven Wire Stress Relieved Strand for Prestressed Concrete" and "Specification for Unbonded Single Strand Tendons" as published by the Post-Tensioning Institute.

19. Prestressing Bars: All prestressing bars shall be deformed threadbars conforming to ASTM A 722 "Specification for Uncoated High Strength Steel Bar for Prestressing Concrete", with a minimum ultimate tensile strength of 150 KSI and other properties as specified on page 11-21 of the PCI Design Handbook, fifth edition. Threadbars, plate anchorages and couplings shall be furnished by Dywidag Systems International or Williams unless approved otherwise in writing by the Engineer.

20. Wire: Smooth wire for spiral reinforcement shall conform to ASTM A 82 with a minimum yield strength of 70,000 PSI.

21. Epoxy-Coated Plain-Steel Wire: ASTM A 884, Class A, plain-steel wire.

22. Joint Dowel Bars: Smooth bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 615, Grade 40 or ASTM A 36, plain-steel bars. Cut bars true to length with ends square and free of burrs

23. Epoxy-Coated Joint Dowel Bars: Smooth epoxy-coated bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 775 with ASTM A 615, Grade 40 or ASTM A 36 plain-steel bars. Cut bars true to length with ends square and free of burrs.

24. Dowel Bar Sleeves: Plastic or gage metal (26 ga. min.) sleeves with an inside diameter of 1/16 inch greater than the dowel bar that it encases, that have the strength, durability, and design to provide free movement of the dowel relative to the concrete slab and that are specifically manufactured for this purpose.

25. Alternate Slab-on-Grade Joint Load Transfer Systems: A system that consists of flat, ASTM A 36 plate that is saw cut into a square or rectangular shape and is embedded into or encased by a plastic sleeve that allows movement in both lateral directions but not in the vertical direction. Acceptable systems are manufactured by PNA Construction Technologies with products known by the names “Diamond Dowel System” and “PD^3 Basket” and Greenstreak Group Inc. with products known as “Speed Plate’ and “Double-Tapered Basket”.

26. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge.

    a. Tie wire in architecturally exposed concrete shall be plastic coated or stainless steel.
    b. Tie wire for epoxy-coated reinforcement shall be epoxy-coated.
    c. Tie wire for galvanized reinforcement shall be galvanized.

27. Headed Steel Stud Punching Shear Reinforcement: Punching shear reinforcement using headed studs welded to flat bars shall be manufactured in conformance with ASTM A1044 and approved by the ICC Evaluation Service, Inc. as expressed in an ICC Evaluation Report for use as punching shear

reinforcement for slabs and footings designed in accordance with ACI 421.1. The following are acceptable products:,“Decon Studrails”, Decon “Dayton Shear Resistance System (DSR) D-140”, Dayton Superior Corporation “Suncoast Stud Reinforcement System”, Suncoast Post-Tension, Ltd.

28. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations.

a. Slabs-on-Grade: Use precast concrete bar supports (dobies) or supports with sand plates or horizontal runners designed for use on ground.
b. Spread Footing Bottom Reinforcement: Use precast concrete bar supports (dobies) or chairs designed for soil-supported slabs.
c. Mat Foundation: Use precast concrete bar supports (dobies), chairs designed for soil-supported slabs, or poured-in-place concrete curbs.
d. Exposed to View Concrete: Provide supports with legs which are plastic protected stainless steel protected (CRSI, Class 2).
e. Support of Epoxy-Coated Reinforcement: Provide epoxy-coated or other dielectric-polymer-coated wire bar supports to support epoxy-coated reinforcement.
f. Support of Galvanized Reinforcement: When NOT exposed to view, provide galvanized wire bar supports to support galvanized reinforcement. In all exposed to view conditions provide supports with legs which are plastic protected stainless steel protected (CRSI, Class 2).

B. Coating Repair Materials: Repair damaged areas of epoxy-coated or galvanized reinforcement using the following products.

1. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating compatible with epoxy coating on reinforcement and complying with ASTM A 775.

2.2 Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc shall be used to repair damaged areas of galvanized reinforcement.

2.3 SPLICES

A. End Bearing Compression Splices: Members with end bearing compression splices shall have vertical bars saw cut or otherwise finished for true bearing. Bar ends shall terminate in flat surfaces within 1 1/2 degrees of a right angle to the axis of the bars and shall be fitted within 3 degrees of full bearing after assembly. Splice bars shall be held in concentric contact by a suitable device. The following are acceptable end bearing compression devices:

"Speed Sleeve", Erico Products, Inc. "G-Loc", BarSplice Products, Inc.
or other Engineer-approved product.

B. Mechanical Tension Splices:

1. Mechanical splices shall conform to Type 1 and Type 2 splices.

   a. Type 1 splice shall develop 1.25 times the specified yield strength of the splice bar.
   b. Type 2 splice shall meet the requirements of Type 1 splice and, in addition, develop the full tensile strength of the splice bar.

2. Splices shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Report submitted for Engineer review.

3. The bar ends that are to attach to the splice shall be prepared and installed in accordance with the manufacturer's requirements.

4. The following are acceptable mechanical tension splices (splices qualified for use with grade 75 bars are parenthetically noted): "BarLock, S-Series", Dayton Superior.
   "US/MC-SAE Mechanical Coupler", Dayton/Richmond, Inc. "DB Grout Sleeve", Dayton/Richmond "ZAP Screwlok", BarSplice Products, Inc. (qualified for use with grade 75 bars) "BPI Grip XL System", Barsplice Products, Inc. "Taper Threaded Grip Twist System", Barsplice Products, Inc. "Lenton Coupler", Erico Products, Inc. (for grade 75 bars, use only "Standard Coupler") "NMB Splice Sleeve", Splice Sleeve North America" (qualified for grade 75 #7 bars and higher) "BarLock, L-Series", Dayton Superior "Taperlok Couplers", Dayton Superior "Lenton Interlok", Erico Products, Inc. "Griptec", Dextra Manufacturing Co. or other Engineer-approved product.

C. Dowel Bar Replacement: All grade 60 reinforcing steel dowel bars shown on the drawings crossing concrete construction joint surfaces with inserts cast flush against the form and having reinforcing bars connected to the insert in a subsequent concrete pour shall conform to the following:

1. Splice connection to the insert shall develop the 1.25 times the specified yield strength and the full tensile strength of the spliced bar.

2. Splices shall be approved by the ICC Evaluation Service, Inc. as expressed in an ICC Evaluation Service Report which shall be submitted for review.

3. The following are acceptable products (for use only with grade 60 bars):
4. "Lenton Form Saver", Erico Products, Inc. "DB-SAE Dowel Bar Splicer", Dayton/Richmond, Inc. or other Engineer-approved product.

D. Hooked Anchorage Replacement: Reinforcing bar terminations shall be manufactured out of ASTM A 576 material and shall develop the full tensile strength of the bar when installed at the manufacturer's recommended depth.

1. The anchorage shall be approved by the ICC Evaluation Service Inc. as

expressed in an ICC Evaluation Service Report which shall be submitted for review.

2. The following are acceptable products (for use only with grade 60 bars): "Lenton Terminator", Erico Products, Inc. or other Engineer-approved product.

PART 3 - EXECUTION

3.1 FABRICATION AND DELIVERY

A. Bending and Forming: Fabricate bars of indicated sizes and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do not heat reinforcement for bending. Bars shall be free from injurious defects, have a workman-like finish with no excessive rust and/or pitting and have no unusual kinks or bends.

B. Marking and Shipping: Bundle reinforcement and tag in accordance with Section 7.4.5 of the CRSI "Manual of Standard Practice". Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.

C. Repair of Epoxy-Coated Reinforcing: Repair cut and damaged epoxy coatings on fabricated reinforcing before delivery with epoxy repair coating according to ASTM D 3963

3.2 PLACING REINFORCEMENT

A. Comply with CRSI recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.

B. Before placing reinforcement and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers and hangers, as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set tie wires so ends are directed into concrete, not toward exposed concrete surfaces.

E. Support of Spread Footing Reinforcing Steel

1. Bottom Steel: Support bottom reinforcing mat to provide the specified

clearance to the bars. Spacing between supports shall not exceed 4'-0" centers each way.

2. Top Steel: Support top reinforcing on steel angle frames braced in both directions or on special standee support bars. Spacing between supports shall not exceed 4'-0" centers each way. The depth of the supports shall provide the specified clearance from the bars to the top of the concrete. The design of the support steel shall be the responsibility of the Contractor in accordance with Concrete Reinforcing Steel Institute (CRSI), “Manual of Standard Practice”.

F. Support of Mat Foundation Reinforcing Steel

1. Bottom Steel: Support bottom reinforcing mat to provide the specified clearance to the bars. Spacing between supports shall not exceed 4'-0" centers each way.

2. Top Steel: Support top reinforcing on steel angle frames braced in both directions or on special standee support bars. Spacing between supports shall not exceed 4'-0" centers each way. The depth of the supports shall provide the specified clearance from the bars to the top of the concrete. The design of the support steel shall be the responsibility of the Contractor in accordance with Concrete Reinforcing Steel Institute (CRSI), “Manual of Standard Practice”.

G. Install welded wire reinforcement in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus two inches and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

H. Coordinate with other trades and expedite materials and labor to avoid omissions and delay.

I. Install waterproof membrane or vapor barrier as specified prior to placing steel for concrete slabs-on-grade.

J. Extend reinforcement continuous through construction joints unless otherwise shown on the drawings.

K. Slab-on-Grade Joint Dowel Bars: Support slab-on-grade joint dowel bars independently of support for slab reinforcement on soil supported slab bolsters or specially manufactured cradles such that dowel bar remains parallel to slab surface and at right angles to joint during concreting operations. Lightly coat the exposed end of the dowel with a paraffin-base lubricant, asphalt emulsion, form oil, or grease or use a dowel bar sleeve.

L. Alternate Slab-on-Grade Joint Load Transfer Systems: Install the alternate load transfer system in accordance with the manufacturer’s instructions such that the largest plane of the flat plate is parallel to the plane of the subgrade on which the slab is bearing.

M. Provide and place additional reinforcing steel at all sleeves and openings in beams,

slabs and walls as specified on the drawings. Where sleeves or openings not shown on the drawings interrupt the reinforcement, consult with Engineer for instructions for placing and splicing of bars. Provide required additional reinforcing steel at no additional cost to the Owner.

N. Epoxy-Coated Reinforcement: Use epoxy-coated steel tie wires to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.

O. Galvanized Reinforcement: Use galvanized steel tie wires to fasten galvanized reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

3.3 SPLICING REINFORCING STEEL

A. Provide splice as indicated on the drawings. Splice reinforcing bars only at locations shown on the structural drawings and approved shop drawings. Unauthorized or unscheduled splices not approved by the Engineer in writing will not be accepted.

B. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.

C. Maintain proper cover between reinforcing bars at splices.

D. Lap unscheduled reinforcing bars not otherwise specified a minimum of 30 bar diameters at splices. Lap welded wire fabric a minimum of one full wire mesh plus two inches.

E. Reinforcing Steel Placement in Mat Foundations

1. Size, length, spacing, and location of all mat reinforcing steel is shown on the mat plans and details. See details on the drawings for required stagger pattern of top and bottom bar splices and for sequence of placing mat reinforcing steel layers.

2. The number of splices shall be minimized by using bar runs of 60'-0" as much as possible. Unless noted otherwise, continuous top reinforcing bars shall be spliced along column centerlines. Continuous bottom reinforcing bars shall be spliced mid-way between columns.

3. Provide Class B tension lap splices for all bars #11 and smaller. Stagger splices as shown in the typical details.

4. Avoid splices of #14 and #18 bars where possible. Where required, a mechanical tension splice as specified shall be provided. No more that 50% of such bars shall be spliced in any 5'-0" width of mat cross-section. Spliced bars shall be staggered with un-spliced bars.

F. Manufacturer of mechanical tension splice shall be present for first day's installation.

3.4 WELDING REINFORCING STEEL

A. Welding reinforcing steel is permitted only where specifically shown on the drawings. All welding shall conform to AWS D1.4. Only weldable reinforcing steel conforming to ASTM A 706 or deformed bar anchors conforming to ASTM A 496 shall be permitted. ASTM A 615 bars may not be welded for structural use.

B. Tack welding of reinforcement shall only be allowed for preassembled mats and cages.

3.5 SHRINKAGE AND TEMPERATURE REINFORCEMENT

A. Provide shrinkage and temperature reinforcement as indicated on the drawings at right angles to main top and bottom bars for all structural slabs unless detailed otherwise on the drawings.

3.6 PLACEMENT OF WELDED WIRE REINFORCEMENT

A. Wherever welded wire reinforcement is specified as reinforcement in pan-formed beams or slabs, it shall be continuous and properly lapped one full wire spacing plus 2" across the entire concrete surface and not interrupted by beam or girders.

3.7 REINFORCEMENT IN JOIST DISTRIBUTION RIBS

A. Provide reinforcement in ribs, minimum one - #5 continuous top and bottom unless indicated otherwise on the drawings.

3.8 REINFORCEMENT IN COMPOSITE METAL DECK SLAB

A. Composite metal deck slabs shall be reinforced as indicated on the drawings.

B. Extra Reinforcement Over Girders: Provide additional reinforcing steel over interior girders as shown on the drawings.

C. Placement of Slab Reinforcement: Provide bolsters, highchairs, and/or additional reinforcing as shown in details on the drawings to support the reinforcing with the clear cover shown on the drawings.

3.9 FIBER-REINFORCED CONCRETE IN TOPPING SLABS, SIDEWALKS, AND DRIVEWAYS

1. Provide fibers of the type and at the dosage rate shown on the drawings.

2. The fiber-reinforced concrete shall be produced in accordance with ASTM C 1116 and have a residual strength of 80 psi when tested in accordance with ASTM C 1399.

3.10 REINFORCEMENT AROUND OPENINGS IN COMPOSITE METAL DECK SLABS

A. For all openings in metal deck not framed with structural steel and greater than 10" in width in either direction, provide additional reinforcing steel as shown in details on the drawings.

3.11 REINFORCEMENT IN PAN-FORMED BEAM SLABS

A. Reinforcement: Provide reinforcing in pan-formed beam slabs as shown on the drawings.

B. Placement of Slab Reinforcement: Provide required bar supports and additional reinforcing as shown in details on the drawings to support slab reinforcing with the clear cover shown on the drawings.

3.12 REINFORCEMENT IN GRADE BEAMS

A. Provide reinforcing in grade beams as shown on the drawings.
B. Bar Support for Grade Beam Cages: Grade beam bottom steel shall be supported at 5'-0" maximum centers using beam bolsters that provide 3" bottom cover to the reinforcing steel. Beam bolsters used shall be designed and manufactured for support on soil.

3.13 REINFORCEMENT IN TOPPING SLABS

A. In addition to fiber reinforcing, provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all topping slabs unless specified otherwise on the drawings.

3.14 REINFORCEMENT IN HOUSEKEEPING PADS

A. In addition to fiber reinforcing, provide welded smooth wire reinforcement 6 x 6 W2.9 x W2.9 minimum in all housekeeping pads supporting mechanical equipment unless detailed otherwise on the drawings.

3.15 REINFORCEMENT IN SIDEWALKS

A. In addition to fiber reinforcing, provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all sidewalks unless detailed otherwise in the Contract Documents.

3.16 MECHANICAL AND PLUMBING REQUIREMENTS

A. Refer to Mechanical and Plumbing Drawings for concrete requiring reinforcing steel. Such reinforcement shall be furnished as part of the work of this section.

3.17 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for reinforcing inspection and testing requirements.

END OF SECTION 03 20 0

SECTION 03 30 00-
CAST-IN-PLACE
CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

B. Concrete paving and walks are specified in Division 32, Concrete Formwork – 03 10 00, Concrete Reinforcement – 03 20 00, Architectural Precast Concrete – 03 45 00, Structural Precast Concrete – 03 41 00, Post-Tensioned Concrete – 03 38 00, and special requirements for Tilt-up Concrete Construction – 03 47 13 are specified in other Division 03 sections.

1.2 DESCRIPTION OF WORK

A. Extent of concrete work is shown on drawings, including schedules, notes and details which show size and location of members and type of concrete to be poured. Furnish all labor, materials, services, equipment and hardware required in conjunction with or related to the forming, delivery and pouring of all cast-in-place concrete Work.

1.3 ENVIRONMENTAL OBJECTIVES

A. The Owner has established environmental goals and strategies for achieving them for this project based upon the LEED® Green Building Rating System for New Construction & Major Renovations Version 2009, as developed by the U.S. Green Building Council. Refer to Division 101 Section "Sustainable Design Requirements.", if feasible and economical.

B. Manufacturer to supply documentation of level of compliance or non-compliance with the following requirements before consideration as an "acceptable manufacturer:"

1. The following are mandatory requirements for the overall project:

a. The material(s) in the product(s) supplied should have a recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes at least **6%** of the total value of the material in the project, if feasible and economical.

b. **50%** of the product(s) supplied is extracted, processed, and

manufactured regionally within a radius of 500 miles of this Project, if feasible and economical.

1.4 QUALIFICATIONS

A. The concrete supplier shall have a minimum of five years experience in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. The supplier must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

B. The concrete contractor shall have a minimum of five years experience with installation of concrete similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful –service performance.

C. Any testing laboratory retained by the Contractor or Subcontractor to run tests required by this specification but not performed by the Owner's testing laboratory shall meet the basic requirements of ASTM E 329.

1.5 QUALITY CONTROL

A. The Contractor is responsible for control of quality, including workmanship and materials furnished by his subcontractors and suppliers.

B. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. ACI 301 – "Specifications for Structural Concrete for Buildings".

2. ACI 117 – 'Specifications for Tolerances for Concrete Construction and Materials."

3. ACI 318 – "Building Code Requirements for Reinforced Concrete".

4. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

5. Steel Construction Manual, 13th edition, American Institute of Steel Construction

C. Document Conflict and Precedence: In case of conflict among Contract Documents and Contract Specifications, request clarification from the Architect/Engineer through "Request for Information" (RFI) process before proceeding with the Work. In case of a conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.

D. Inspection and Testing of the Work: Materials and installed work may require testing and retesting, as directed by the governing building code, the Architect/Engineer, or the Owner at any time during progress of work.

1. The Contractor shall provide forty-eight (48) hours notification to the Owner's Testing Laboratory of construction operations including the project schedule to allow the Testing Laboratory to schedule inspections. Failure to sufficiently notify may result in additional costs incurred by the Testing Laboratory that may be back-charged to the Contractor by the Owner.

2. The Contractor shall cooperate with laboratory personnel and provide access to the work.

3. The Contractor shall make arrangements with and for the Owner's Testing Laboratory for off-site inspection of material stockpiles, concrete delivery vehicles, concrete material storage facilities, and concrete-batching facilities.

4. If required, the Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.

5. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Tests not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense. See Testing Laboratory section, 01 45 29, of the Specifications.

E. Acceptance Criteria for Concrete Strength: A strength test is defined as the average strength of two 6" x 12" cylinder breaks or three 4" x 8" cylinder breaks tested at the strength age indicated on the drawings for that class of concrete. The strength level of an individual class of concrete shall be considered satisfactory when both of the following requirements are met:

1. The average of all sets of three consecutive strength tests equal or exceed the required f'c.

2. No individual strength test falls below the required f'c by more than 0.1 f'c or 500 psi, whichever is greater.

F. Responsibility for Selection and use of concrete admixtures and chemical treatments: The Contractor shall be responsible for selecting admixtures and surface treatments that are compatible with the intended use of the concrete including all final surface treatments called for within this or other specifications or on the Contract Drawings. The Contractor is responsible for following the manufacturer's instructions for the use of their product including

abiding by any limitations placed by the manufacturer on the use of any of its products.

G. Survey for Anchor Rods and Reinforcing Steel Dowels: The Contractor shall use a qualified and experienced filed engineer (construction surveyor), having a minimum of three years of experience as “lead” field engineer on projects of similar type, lay out the proper location of all embedded anchor rods, embedded connection plates for structural steel columns and beams, tension rods for structural precast, and correct location and elevation of concrete column dowels before they are encased in concrete.

H. Manufacturer Representative Presence:

1. Post-installed anchors: The manufacturer’s representative for each post-installed anchor product (adhesive, expansion, undercut, screw, or insert anchor) shall be present during the first day’s installation of the product to observe whether the anchors are installed according to manufacturer’s instructions.

2. Fiber-reinforced concrete: The manufacturer’s representative for each fiber type shall be present during the first pour in which the fiber is used to observe whether the dosage rate and placing and finishing method is in accordance with the specifications and the manufacturer’s instruction.

1.6 PREINSTALLATION CONFERENCES

A. Mix Design Conference: At least 30 days prior to submittal of concrete design mixes, the Contractor shall hold a meeting or telephone conference to review the detailed requirements for preparing the concrete mix designs. Participants shall include representatives from the Contractor, UH Facilities Project Inspector, Owner’s Testing Laboratory, Concrete Supplier, Architect, and Engineer.

B. Pre-Concrete Conference:

1. At least 7 days prior to beginning concrete work, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss required methods and procedures to produce concrete construction of the required quality. Also review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for materials inspection, testing and certifications. The contractor shall send a pre-concrete conference agenda to all attendees 7 days prior to the scheduled date of the conference.

2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference,

including but not limited to the following: Contractor's Superintendent Laboratory responsible for field quality control and batch plant quality control Concrete Subcontractor Ready-Mix Concrete Producer Concrete Pumping Contractor Fiber Reinforcement Representative Owner's and Architect's/Engineer's Representative

3. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:

   Owner's Representative
   Facilities Project Inspector
   Engineer-of-Record

4. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least 7 days prior to the scheduled date of the conference.

1.7 SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including admixtures, patching compounds, epoxies, grouts, waterstops, joint systems, fiber reinforcement, curing compounds, dry-shake finish materials, hardeners, sealers mechanical splices, hooked anchorage systems, dowel bar substitute systems, dowel bar sleeves, joint fillers, and others as requested by Architect/Engineer.

B. Samples: Submit samples of materials specified if requested by Architect/Engineer, including names, sources and descriptions.

C. Mix Designs: Submit mix designs as specified herein.

D. Material and Mill Certificates: Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. The Manufacturer and Contractor shall sign the material and mill certificates certifying that each material item complies with specified requirements. Provide certification from admixture manufacturers that chloride ion content complies with specified requirements.

E. Construction Joints: Submit drawing of proposed construction joint locations in concrete for slab on grade, mat foundations, structural floors, roofs and walls. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on the drawings.

F. Pour Sequence for Mat Foundation: Submit proposed pour sequence for mat foundations.

G. Industrial Slabs: Submit proposed pour sequence and procedure for protecting concrete during placement, finishing, and curing.

H. Minutes of preconstruction conference.

I. Surveys: Submit report certifying that all anchor rods and reinforcing dowels into columns above are in their proper location prior to placing of concrete.

J. LEED Submittals (Projects authorized for LEED certification only)

1. Recycled Content- Credit MR4.1/MR 4.2: Provide documentation indicating percentages of post-consumer and pre-consumer recycled content by weight per unit of product or assembly containing the product. Indicate the percentage of the dollar value of the recycled content compared to the total dollar value of the product or assembly containing the product.

2. Material Proximity- Credit MR 5.1/MR 5.2: Where the distances to the project site is 500 miles or less, indicate location and distance to project site of extraction, harvesting, recovery and manufacturing of all materials. Indicate the dollar value of the material cost of the product containing local/regional materials. Where product components are sourced or manufactured in separate locations, provide location and percentage by weight of each component per unit of product.

1.8 PROVISION FOR OTHER WORK

A. Provide for installation of inserts, hangers, metal ties, anchors, bolts, angle guards, dowels, thimbles, slots, nailing strips, blocking, grounds and other fastening devices required for attachment of work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves or blockouts in any concrete slabs, beams or columns except where shown on the drawings or upon written approval of the Architect/Engineer.

B. Protect adjacent finish materials against damage and spatter during concrete placement.

C. To maintain location accuracy, the General Contractor's field engineer shall furnish building control lines and elevation benchmarks for the use of all trades.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Refer to the drawings for classes and strengths of concrete required.

B. Hydraulic Cement:

1. Use ASTM C 150, Type I or Type III, or ASTM C 1157, Type GU or HE unless otherwise specified. Do not use Type III cement in slabs on grade unless approved in advance by the Engineer.

2. Concrete exposed to sulfates in soil or water
   a. Exposure class S1: For areas designated on the drawings as exposure class S1, use ASTM C 150, Type II or ASTM C 1157, Type MS.
   b. Exposure class S2: For areas designated on the drawings as exposure class S2, use ASTM C 150, Type V or ASTM C 1157, Type HS.
   c. Alternate cement types for exposure classes and S2: ASTM C 150, Type I or III cement may be used for concrete exposed to exposure S1 or S2 if the tricalcium aluminate (C3A) content is less than 8 percent for S1 exposure or 5 percent for S2 exposure ASTM C 150, Type I or III cement may be used for exposure to seawater if the tricalcium aluminate content does not exceed 10 percent and the w/cm ratio of the concrete mix does not exceed 0.40.
   d. Exposure class S3: For areas designated on the drawings as exposure class S3, use ASTM C 150, Type V plus pozzolan or slag or ASTM C 1157, Type HS plus pozzolan or slag or ASTM C 595, Type IP (HS) or Type IS (HS). The amount of pozzolan or slag added or in a blended mix shall be such that has been determined by service record to improve sulfate resistance when used with Type V cement or the amount that when tested according to ASTM C 1012 meets the criteria of table 4.5.1 in ACI 318-08.

3. Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Architect/Engineer and the Owner's Testing Laboratory. Submit mill certificates certifying conformance to this specification for each brand and type of cement. Documentation of design mix strength history must match the cement brand used.

4. Testing of cement in lieu of mill certificate submittal will be required if:

   a. The cement has been in storage at the mixing site for over 30 days
   b. It is suspected by the Owner, Architect, Engineer or Owner's Testing Laboratory that the cement has been damaged in storage or in transit or is in any way defective.

C. Low-alkali cement: Cement that has the additional requirement that equivalent alkalis (Na2 O + 0.658K2 O) do not exceed 0.60% according to ASTM C 150-00, Table 2.

D. Expansive Cement: ASTM C 845, Type K.

E. Fly Ash: ASTM C 618, Class C or F.

F. Silica Fume: ASTM C 1240, Amorphous Silica.

G. Slag Cement: ASTM C 989, Grade 100 or 120 or ASTM C 595, Type IS or Type S.

H. Normal weight Aggregates: ASTM C 33, and as herein specified. Submit material certificates from aggregate supplier or test results from an independent testing Labratory certifying conformance to this specification for each source of aggregate.

1. For concrete identified on the drawings as exposed to exposure classes C1 and C2, submit certification that aggregate does not contain any deleterious materials that react with alkalis in the concrete mix to cause excessive expansion of the concrete for concrete that is exposed to wetting, has extended exposure to humid atmosphere, or is in contact with moist ground unless low-alkali cement is used.

I. Lightweight Aggregates: ASTM C 330. Submit material certificates from aggregate supplier or test results from an independent testing Labratory certifying conformance to this specification for each source of aggregate.

J. Water: Comply with the requirements of ASTM C 1602

K. Cementitious materials, aggregate, and water must be extracted or recovered as well as manufactured within 500 miles of the project site.

L. Air-Entraining Admixture: ASTM C 260.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Darex" or "Daravair" series; W. R. Grace & Co.
“MB-VR”, "MB-AE90" or "Micro-Air"; BASF Admixtures, Inc "Sika AER"; Sika Corporation "Air Mix" or "AEA-92"; the Euclid Chemical Company
“Eucon Air 30” or “Eucon Air 40”, the Euclid Chemical Company.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

M. Water-Reducing Admixture: ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Pozzolith" series; BASF Construction Chemicals "Plastocrete 161"; Sika Chemical Corp. "Eucon WR-75 or WR-91"; the Euclid Chemical Company. "WRDA "; series W.R. Grace & Co. “Eucon NW” or “Eucon LW”, the Euclid Chemical Company

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

N. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A and Type F. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:
“Polyheed” series, BASF Construction Chemicals “Eucon MR”, the Euclid Chemical Company “Sikament HP”, Sika Chemical Corp. “Daracem” or “Mira” series, W.R. Grace & Co. “Eucon X15” or “Eucon X20”, the Euclid Chemical Company

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

O. High-Range Water-Reducing Admixture (superplasticizer): ASTM C 494, Type F or Type G. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"ADVA" or "Daracem" Series; W.R. Grace & Co. "Rheobuild 1000" or "Glenium" series; BASF Construction Chemicals "Sikament"; Sika Chemical Corp. "Eucon 37/1037” or ”Plastol" series; the Euclid Chemical Company “Euconl SP” or “Eucon RD”, the Euclid Chemical Company

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

P. Water-Reducing, Accelerator Admixture (Non-Corrosive, Non-Chloride): ASTM C 494, Type C or E. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Polarset";”Gilco”, “Lubricon NCA” or “DCI”, W.R. Grace & Co. "Pozzutec 20+"; BASF Construction Chemicals "Accelguard 80/90"; “NCA”, or “AcN”, the Euclid

Chemical Company “Plastocrete 161FL”, Sika Chemical Co. “Eucon AcN”, the Euclid Chemical Company

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

Q. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. See maximum permissible chloride ion content in concrete specified below.

Subject to compliance with requirements, provide one of the following products and manufacturers:

"Daratard" series, W.R. Grace & Co. "Pozzolith" series or "DELVO” series; BASF Construction Chemicals "Plastiment"; Sika Chemical Co. “Eucon Retarder”, Series, the Euclid Chemical Company

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

R. Viscosity Modifying Admixture: Used to enhance plastic concrete properties such as workability, pumpability, and stability for “self-consolidating concrete”. “Rheomac VMA” series, BASF Construction Chemicals “Eucon SL” or “Visctrol”, the Euclid Chemical Company “VisoCrete” series, Sika Chemical Co. “VMAR” series, W.R. Grace & Co.

S. Shrinkage Reducing Admixture: An admixture that reduces drying shrinkage by reducing the capillary tension of pore water.

Subject to compliance with requirements, provide one of the following products and manufacturers:

For Air-Entrained Concrete: "Eclipse Plus"'; Grace Construction Products "Eucon SRA"; the Euclid Chemical Company

For Non Air-Entrained Concrete

“Eclipse Floor”, Grace Construction Products “Tetraguard AS20”, BASF Construction Chemicals

T. Corrosion Inhibitor: 30% calcium nitrite

Products: Subject to compliance with requirements, provide the following at dosage rates per Engineer of Record from manufacturer’s recommendation based on design life, application, clear cover and other products in concrete mix: "Eucon CIA" or “Eucon BCN”, the Euclid Chemical Company "DCI" or “DCI-S”, W.R. Grace & Co. "Rheocrete CNI", BASF Construction Chemicals “Sika CNI”, Sika Chemical Co.

U. Corrosion Inhibitor: Amine-Ester type

Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer's recommendation: "Rheocrete 222+", BASF Construction Chemicals

V. Crystalline-forming Waterproofing Admixture: A powder admixture capable of producing concrete that is watertight under hydrostatic pressure up to 7 atmospheres when tested in accordance with Corps of Engineers test CRD-C48 and capable of sealing cracks up to 0.4mm.

Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer's recommendation:

"Penetron Admix", ICS/Penetron International/Ltd." Krystol Internal Membrane", Kryton International, Inc. "Xypex C series", Xypex Chemical Corporation "Rheomac 300D", BASF Construction Chemicals

W. Calcium Chloride and Chloride Ion Content: Calcium chloride or admixtures containing more than 0.5% chloride ions by weight of the admixture are not permitted. For concrete exposed to sulfate exposure class S2 or S3 as noted on the drawings, admixtures must be completely free of chloride ions.

X. Certification: Written conformance to all the above-mentioned requirements and the chloride ion content of the admixture as tested by an accredited laboratory will be required from the admixture manufacturer at the time of mix design review by the Engineer.

2.2 RELATED MATERIALS

A. Waterstops: Provide waterstops at all construction joints and other joints in all foundation walls below grade and where shown on the drawings. Size to suit joints. Provide flat, dumbbell type or center bulb type where shown on drawings.

1. ADCOR ES waterstops: W.R. Grace & Co.

2. Polyvinyl chloride (PVC) waterstops: Corps of Engineers CRD-C 572.

3. Preformed Plastic Waterstops: Federal Specifications SS-S-210A "Sealing Compound for Expansion Joints".

Manufacturers: Synko-Flex Products, Inc.

4. Bentonite Waterstop RX manufactured by American Volclay Products.

B. Vapor Retarder: Provide vapor retarder cover chosen from products specified below over prepared base material where indicated.

1. Plastic Vapor Retarder Provide a flexible preformed sheet membrane conforming to ASTM E 1745 with the following properties.

    a. Class A material
    b. Minimum of 15 mils thick
    c. Maximum water vapor permeance rating of 0.01 Perms after mandatory conditioning as tested by ASTM E 96
    d. Acceptable products include the following: "Stego Wrap Vapor Barrier (15 mil)", Stego Industries, LLC "Ecoshield-E" (15 mil), Epro "Monarflex Reflex Super, Monarflex

2. Tape for Plastic Vapor Retarders: High-density polyethylene tape with pressure sensitive adhesive having a minimum width of 4 inches having a maximum water vapor transmission rate of .3 perms.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171:

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

4. Polyethylene-coated natural cellulose fabric such as "Aquacure" by Greenstreak Group, Inc.

5. Cover for Industrial Slab: Provide a low permeance moisture-retaining cover that allows a moisture loss of no more than 1 lb/sq. yd. in 72 h when tested in accordance with ATSM C 156 for industrial slabs. The material shall be non- staining with a tensile strength meeting ASTM D 882 and a minimum retention capacity of 6.5 g.

E. Slip-resistive Emery Aggregate or Aluminum Granule Finish: Provide fused aluminum- oxide granules, or crushed emery, as abrasive aggregate for slip-resistive finish. The emery aggregate shall contain not less than 50% aluminum oxide and not less than 20% ferric oxide. The aluminum aggregate material shall contain not less than 95% fused aluminum-oxide granules. Use material that is factory-graded, packaged, rust-proof and non-glazing, and is unaffected by freezing, moisture and cleaning materials. Subject to compliance with requirements, provide one of the following: "Emery Tuff Non-Slip", Dayton-Superior "Grip-It" or "Grip-It AO", L&M Construction Chemicals, Inc "Frictex NS", Sonneborn-ChemRex

F. Colored, Mineral Aggregate, Dry Shake Surface Hardener: Packaged, dry, combination of materials, consisting of portland cement, graded quartz aggregate, coloring pigments (if required) and plasticizing admixtures. Use coloring pigments that are finely ground, non-fading mineral oxides, interground with cement. Color, as selected by Architect, unless otherwise indicated. Products: Subject to compliance with requirements, provide one of the following: "Surflex"; the Euclid Chemical Company "Quartz Plate"; L & M Const. Chemical Co. “Lithochrome”, LM Scofield Construction Chemical Co. "Mastercron"; BASF Building Systems "Quartz-Tuff“, Dayton Superior “US Spec Dense Top”, US Mix Co.

Submit manufacturer's certification that product conforms to the requirements specified.

G. Metallic Aggregate Hardener Finish: Packaged dry, combination of materials consisting of Portland Cement, specially processed and graded iron aggregate, coloring pigments (if required) and plasticizing admixtures. The hardener shall be formulated, processed and packaged under stringent quality control. Use coloring pigments that are finely ground, non-fading mineral oxides inter-ground with cement. Color as selected by Architect unless otherwise indicated. "Euco-Plate HD"; the Euclid Chemical Company "Masterplate 200"; BASF Building Systems "Ferro Tuff," Dayton-Superior

H. Non-Oxidizing Metallic Floor Hardener: Packaged dry, combination of materials consisting of portland cement, non-rusting aggregate and plasticizing admixtures. "Diamond Plate," the Euclid Chemical Company "Lumiplate," BASF Building Systems

I. Liquid Membrane-Forming Curing and Curing and Sealing Compounds:

1. Water-Based Dissipating Resin Type Curing Compound: Curing Compound shall be a dissipating resin type, which chemically breaks down after approximately 4 weeks. Membrane forming compound shall meet ASTM C 309, Types 1 or 1D, Class B with VOC content less than 350 g/L.
2. Products: Subject to compliance with requirements, provide one of the following: "Kurez DR Vox”, the Euclid Chemical Company "L&M Cure R", L&M Construction Chemicals “Hydro Cure 309”, Unitex “Sealtight 1100-Clear”, W. R. Meadows “US Spec Maxcure Resin Clear”, US Mix Co.

   Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments and floor coverings.

3. High Solids, Water-Based Acrylic Curing and Sealing Compound with

Moderate Yellowing Characteristics: Water-Based membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, Class B, classified as low odor with a VOC content less than 350 g/L. Product shall provide a maximum moisture loss of 0.030 Kg/m^2 in 72 hours when applied at a coverage rate of 300 sf/gallon. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, resilient flooring, vinyl-backed carpet, wood, or terrazzo, epoxy overlays or adhesives, or other coating or finishing products.

Products: Subject to compliance with above requirements, provide one of the following products or equivalent products: "Safe Cure and Seal (J-19)"; Dayton Superior Corp. "Super Aqua-Cure VOX"; the Euclid Chemical Company "Dress & Seal, 30 WB"; L & M Construction Chemicals, Inc. "Masterkure 200W"; BASF Building Systems “Hydro 18”, Unitex

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

4. High Solids, Water-Based, Non-Yellowing Curing and Sealing Compound: Water based membrane-forming curing and sealing compound, acrylic type, complying with ASTM C 1315, Type 1, Class A classified as low odor with a VOC content less than 350 g/L. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile resilient flooring, vinyl-backed carpet, wood, terrazzo, epoxy overlays or adhesives, or other coating or finishing products.

   Products: Subject to compliance with requirements, provide one of the following: "Super Diamond Clear Vox", the Euclid Chemical Company "Lumiseal 30 WB", L&M Construction Chemicals “Kure 1315”, BASF Building Systems “Hydro Seal 30”, Unitex “Vocomp 30”, W. R. Meadows “US Spec Radiance UV-25”, US Mix Co.

   Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

J. Evaporation Control: Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss in hot weather conditions.

Products: Subject to compliance with requirements, provide one of the following: "Eucobar"; the Euclid Chemical Company "E-Con"; L & M Construction Chemical, Inc. "Confilm"; BASF Building Systems "Sure

Film (J-74)", Dayton Superior "SikaFilm", Sika Chemical Co. “Pro-Film”, Unitex “Sealtight Evapre”, W. R. Meadows “US Spec Monofilm ER”, US Mix Co.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings and surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

K. Chemical Curing/Floor Hardener Compound: Sodium silicate based compound which reacts with concrete constituents to harden the surface, resulting in a surface having a maximum abrasion coefficient of 0.25 cm3/cm2 when tested in accordance with ASTM C 418.

Products: Subject to compliance with requirements, provide one of the following: "Eucosil," the Euclid Chemical Company "Sonosil," BASF Building Systems "Day-Chem S.1-Cure (J-13), Dayton Superior "Chem Hard;" L & M Construction Co. “Uni Cure HD”, Unitex “Med-Cure”, W. R. Meadows “US Spec Permasil”, US Mix Co.

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings and surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

L. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicates per gal.

Products: Subject to compliance with requirements, provide one of the following: "Surfhard"; the Euclid Chemical Company "Lapidolith"; BASF Building Systems
"Day-Chem Hardener (J-15)," Dayton Superior “Fluohard”, L & M Construction Chemical, Inc. “Penalith”, W. R. Meadows

Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings or surface treatments to be received. Submit any instructions that must be followed prior to any subsequent surface treatments.

M. Liquid sealer/densifier: High performance, deeply penetrating concrete densifier that is an odorless, colorless, VOC-compliant, non-yellowing siliconate-based solution containing a minimum solids content of 20%, 50% of which is siliconate.

“Euco Diamond Hard”, the Euclid Chemical Company ”Seal Hard”, L & M Construction Chemical, Inc. “Luqui-Hard”, W.R. Meadows

N. Water and Chloride Ion Repelling Penetrating Sealer: Clear, solvent based silane or siloxane penetrating sealer which reacts chemically with the concrete surface to function as a Chloride Ion screen with a minimum 90% factor when tested in accordance with NCHRP #244, Series II, 100% solids, and applied in accordance with the manufacturer's recommendation.

Products: Subject to compliance with requirements, provide one of the following:

a. “Hydrozo 100”, BASF Building Systems.
b. “Iso-flex 618-100 CRS”, Lymtal International, Inc.
c. “Protectosil Chem-Trete BSM-400”, Evonik Industries

O. Water and Chloride Ion Repelling Penetrating Sealer: Clear, solvent free, silane penetrating sealer which reacts chemically with the concrete surface to function as a Chloride Ion screen with a minimum 83% factor when tested in accordance with NCHRP #244, Series II and applied in accordance with the manufacturer's recommendation.

Products: Subject to compliance with requirements, provide one of the following:

1. 40% solids:

a. "Enviroseal 40" –BASF Building Systems
b. “Iso-flex 618-40 WB”, Lymtal International, Inc.

2. 100% solids:

a. “Protectosil BH-N”, Evonik Industries

P. Bonding Compound: Polyvinyl acetate or acrylic base, for use in cosmetic and/or nonstructural repairs.

Products: Subject to compliance with requirements, provide one of the following:

1. Acrylic or Styrene Butadiene:
"Day-Chem Ad Bond (J-40)"; Dayton Superior "SBR Latex"; the Euclid Chemical Company "Daraweld C"; W. R. Grace
"Acrylic Additive" BASF Building Systems "SikaLatex", Sika Chemical Co.
“Intralok”, W. R. Meadows
“US Spec Acrylcoat”, US Mix Co.
“Akkro 7-T”, the Euclid Chemical Company

2. Polyvinyl Acetate (Interior Use Only)

"Tammseld"; the Euclid Chemical Company "Everweld"; L & M Construction Chemicals, Inc. "Superior Concrete Bonder (J-41)," Dayton Superior “US Spec Bondcoat”, US Mix Co.

Q. Epoxy Products: Two component material suitable for use on dry or damp surface, complying with ASTM C 881.

1. Products for Crack Repair:
"Sikadur 35 Hi Mod LV"; Sika Chemical Company – injection type
"Sikadur 52", Sika Chemical Company – injection type
"Sikadur 55 SLV", Sika Chemical Company – gravity feed "Eucopoxy Injection Resin," the Euclid Chemical Company "Sure-Inject (J-56),"

Dayton Superior “Epofil SLV”, BASF Building Systems “ETI-LV” or “ETI-GV”, Simpson Strong-Tie Co., Inc. – injection type “Pro-Poxy 100 LV” or “Pro-Poxy 50”, Unitex “Crackbond”, U.S. Anchor Corp. “Rezi-Weld LV”, W. R. Meadows “US Spec Maxibond” US Mix Co. – injection or gravity feed “US Spec Eposeal LVS”, US Mix Co. – gravity feed “Duralcrete LV”, the Euclid Chemical Company

2. Products for Epoxy Mortar Patches:
"Sikadur Lo-Mod LV"; Sika Chemical Corporation ""Duracrete”, the Euclid Chemical Company "Sure Grip Epoxy Grout (J-54)," Dayton-Superior “Epofil”, BASF Building Systems “Pro-Poxy 2500”, Unitex “Rezi-Weld 1000”, W. R. Meadows “US Spec EPM 3000”, US Mix Co. “Duralcrete LV”, the Euclid Chemical Company

3. Products for Epoxying steel plates to concrete: conform to ASTM C 881-90, Type IV, Grade 3, Class A, B, & C except gel times.
"Sikadur 31 Hi-Mod Gel"; Sika Corporation "Sure Anchor I (J-S1)," Dayton Superior "Epo Gel" or "Rapid Gel", BASF Building Systems “Pro-Poxy 300”, Unitex “US Spec Gelbond NS” US Mix Co. “Duralcrete Gel”, the Euclid Chemical Company

4. Products for Adhesive Anchors or Reinforcing Steel in Normal weight Concrete: Product that conforms to ASTM C 881-02, Type IV, Grade 3, Class A, B, & C except gel times, and that is dispensed from a two-component cartridge system through a mixing nozzle that thoroughly mixes the two components as it is injected into the hole.

    a. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published, currently valid, Evaluation Report showing it as having passed Acceptance Criteria 308 shall be approved for use.
    b. Consult with the manufacturer for the minimum temperature of the concrete substrate allowed.
    c. All anchors installed upwardly inclined require continuous inspection unless an exception to the continuous special inspection for upwardly inclined installation is noted on the drawings.
    d. Normal weight Concrete:
    “HIT-RE 500-SD”, Hilti Fastening Systems (periodic inspection unless anchors are installed upwardly inclined) “SET-XP” Adhesive”, Simpson Strong-tie (periodic inspection unless higher factors are used in design requiring continuous inspection as noted on the drawings or anchors are installed upwardly inclined) “PE 1000+”, Powers Fasteners, Inc. (periodic inspection unless anchors are installed upwardly inclined) HIT-HY 150 MAX-SD”, Hilti Fastening Systems (periodic inspection unless anchors are installed upwardly inclined)

e. Lightweight Concrete:

No approved products

f. These products may not be used in concrete cast over corrugated deck.

g. Install only anchors identified on the drawings by manufacturer and product. Substitutions using products approved by this Specification may be permitted provided complete design calculations, as required by and in accordance with the proposed product's current and valid ICC Evaluation Service Report (ESR) and ACI 318 Appendix D, are signed and sealed by a professional engineer licensed in the state where the project is located and furnished to the Engineer for review and approval prior to commencement of work. The contractor shall request design criteria for all conditions where a product substitution is considered. Failure to obtain approval for an anchor substitution may result in the request by the Engineer to remove installed anchors and replace with the product specified on the drawings at the Contractor's expense.

R. Self-Leveling Mortars, Underlayment Compound: Free flowing, self-leveling, pumpable cementitious base compound. Follow manufacturer's instruction regarding the use of a bonding agent.
Products: Unless specified otherwise, provide one of the following: "Sonoflow," BASF Building Systems "Sikatop 111"; Sika Chemical Co.
"Flo-Top" or "Super Flo-Top"; the Euclid Chemical Company "Levelayer I," Dayton Superior
"US Spec Self-leveling Underlayment" US Mix Co. "Level Magic", the Euclid Chemical Company

S. Polymer Patching Mortar: Polymer and microsilica modified cementitious based compounds.

Products:

Horizontal Application

"Thin Top Supreme, Concrete Top Supreme," the Euclid Chemical Company

"Sikatop 121 or 122," Sika Chemical "Emaco R310 CI," BASF Building Systems
"Sonopatch 100 or 200", BASF Building Systems "US Spec H2 or NuTop" US Mix Co.
"Speed Crete PM", the Euclid Chemical Company Upwardly Inclined Application
"Verticoat/Verticoat Supreme," the Euclid Chemical Company "Sikatop 123," Sika Chemical

"Emaco R350 CI," BASF Building Systems “Sonopatch 200”, BASF Building Systems “US Spec V/O Patch”, US Mix Co.
“Speed Crete PM”, the Euclid Chemical Company

T. High Strength Flowing Repair Mortar: For forming and pouring structural members, or large horizontal repairs, provide flowable one-part, high strength microsilica polymer modified repair mortar with 3/8" aggregate. The product shall achieve 9000 psi @ 28- days at a 9-inch slump.

Products:

“Road Patch”, BASF Building Systems “US Spec STR Mortar”, US Mix Co.
“Eucocrete”, the Euclid Chemical Company “Form and Pour”, the Euclid Chemical Company

U. Anti-Corrosive Epoxy/Cementitious Adhesive: Water-based epoxy/cementitious compound for adhesion and corrosion protection or reinforcing members (20 hour maximum open time).

Products:

"Duralprep A.C", the Euclid Chemical Company "Armatec 110," Sika Chemical Co.
“Sonoprep Plus”, BASF Building Systems

V. Expansion and Undercut Anchors in Concrete:

1. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC- ES) with a published, currently valid, Evaluation Report showing it as having passed Acceptance Criteria 193 and approval for use in cracked concrete and resisting wind and seismic loads shall be approved for use.

2. Type: All expansion and undercut anchors in concrete shall be only wedge type expansion, sleeve-type expansion, or undercut type anchors.

3. Interior Use: All anchors, nuts and washers for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.

4. Exterior or Exposed Use: All anchors, nuts and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors, nuts and washers shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.

5. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the anchors.

6. Acceptable Products and Manufacturers – Normal and Lightweight Concrete: “Kwik Bolt TZ”, Hilti Fastening Systems (periodic inspection) “HDA Undercut Anchor” Hilti Fastening Systems (continuous inspection) “HSL-3 Heavy Duty Sleeve Anchor”, Hilti Fastening Systems (continuous inspection) “Strong-Bolt Wedge Anchor”, Simpson Strong-Tie, Co., Inc. (continuous inspection) “Red Head Trubolt + Wedge Anchor”, ITW Red Head (periodic inspection) “DUC Undercut Anchor”, USP Structural Connectors (continuous inspection) “Power Stud + SD1”, Powers Fasteners, Inc (periodic inspection) “Power Stud + SD2”, Powers Fasteners, Inc (periodic inspection) “SRS TZ Carbon Steel Anchor”, MKT Metal-Kunststoff-Technik (continuous inspection)

7. Acceptable Products and Manufacturers – Normal and Light Weight Concrete on Corrugated Deck:
“Kwik Bolt TZ”, Hilti Fastening System (periodic inspection) Strong-Bolt Wedge-Anchor”, Simpson Strong-Tie, Co, Inc. (continuous inspection) Power Stud + SD2”, Powers Fasteners, Inc. (periodic inspection)

8. Install only anchors identified on the drawings by manufacturer and product. Substitutions using products approved by this Specification may be permitted provided complete design calculations, as required by and in accordance with the proposed product’s current and valid ICC Evaluation Service Report (ESR) and ACI 318 Appendix D, are signed and sealed by a professional engineer licensed in the state where the project is located and furnished to the Engineer for review and approval prior to commencement of work. The contractor shall request design criteria for all conditions where a product substitution is considered. Failure to obtain approval for an anchor substitution may result in the request by the Engineer to remove installed anchors and replace with the product specified on the drawings at the Contractor’s expense.

W. Screw and Insert Anchors in Concrete

1. Approvals: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published, currently valid, Evaluation Report showing it as having passed Acceptance Criteria 193 and approved for use in cracked concrete and resisting wind and seismic loads shall be approved for use.

2. Interior Use: All screw anchors for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.

3. Exterior or Exposed Use: All screw anchors for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel.

4. Acceptable Products and Manufacturers – All Conditions:

"Titen HD", Simpson Strong-Tie Co., Inc (continuous inspection) "Snake+Anchor" Powers Fasteners, Inc. (periodic inspection)
"Wedge-Bolt+", Powers Fasteners, Inc. (greater than ¼ in. diameter) (periodic inspection)

5. Install only anchors identified on the drawings by manufacturer and product. Substitutions using products approved by this Specification may be permitted provided complete design calculations, as required by and in accordance with the proposed product's current and valid ICC Evaluation Service Report (ESR) and ACI 318 Appendix D, are signed and sealed by a professional engineer licensed in the state of Texas and furnished to the Engineer for review and approval prior to commencement of work. The contractor shall request design criteria for all conditions where a product substitution is considered. Failure to obtain approval for an anchor substitution may result in the request by the Engineer to remove installed anchors and replace with the product specified on the drawings at the Contractor's expense.

X. Threaded Rods Chemically Anchored in Concrete

1. Type: Threaded rods installed in holes using a chemical anchoring process shall have a 45º chiseled end on one end.

2. Interior and Exterior Application: Meet the requirements of ASTM A 153 galvanized steel, or F 593, Group 1 or 2, condition CW stainless steel.

Y. Anchor Rods:

1. All anchor rods shall conform to the ASTM designation and shall be of the yield strength as specified below as appropriate for the types and at the locations as specified on the drawings:

   a. ASTM F 1554, Grade 36 (1/4 inch to 4 inches in diameter).
   b. ASTM F 1554, Grade 55 (1/4 inch to 4 inches in diameter). (Also comply with Supplementary Requirement S1 of ASTM F 1554)
   c. ASTM F 1554, Grade 105 (1/4 inch to 3 inches in diameter.
   d. ASTM A 588 (corrosion resistant).
   e. ASTM A 354 Grade BD, 130 ksi (to 2 ½ inches in diameter).

f. ASTM A 354 Grade BD, 115 ksi (greater than 2 ½ inches to 4 inches in diameter).
g. ASTM A 354 Grade BC, 109 ksi (to 2 ½ inches in diameter).
h. ASTM A 354 Grade BC, 99 ksi (greater than 2 ½ inches to 4 inches in diameter).

2. Anchor rods used with ASTM A 588 base plates shall be threaded round stock conforming to ASTM A 588, grade 50.

3. Anchor rods used with ASTM A 588 base plates shall be threaded round stock conforming to ASTM A 588, grade 50.

4. Anchor rods used with galvanized base plates shall be galvanized.

5. Nuts: All nuts with anchor rods shall be heavy hex head conforming to ASTM A 563.

6. Washers: Unless noted otherwise on the drawings, washer size and thickness for all anchor rods shall conform to Table 14-2 of AISC “Steel Construction Manual” with holes 1/16” greater than the anchor rod diameter. Washers shall conform to ASTM A 36 steel.

Z. Non-Shrink Grout:

1. Type: Grout for base plates, bearing plates and grouting under precast or tilt-up wall panels shall be a non-metallic, shrinkage resistant, premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents and fluidity improving compounds.

2. Specifications: Non-shrink grout shall conform to ASTM C 1107.

3. Compressive Strength: Provide the minimum strength as shown below as determined by grout cube tests at 28 days:

a. 6,000 PSI for supporting concrete 3000 psi and less.
b. 8,000 PSI for supporting concrete greater than 3000 psi and less than or equal to 4000 psi.
c. Unless noted otherwise on the drawings, grout strength on supporting concrete greater than 4000 psi shall be 8000 psi.

4. Products: Acceptable non-shrink grouts are listed below:
"Crystex"; L & M Construction Chemicals, Inc. "Masterflow 713 Plus"; BASF Building Systems "Set Grout," BASF Building Systems.
"Five Star Grout"; U. S. Grout Corp. "Sonogrout 10K"; BASF Building Systems "NS Grout"; the Euclid Chemical Company
"Sure-Grip High Performance Grout"; Dayton Superior Corp. "CG 200 PC", Hilti, Inc. “CG-86 Grout”, W. R. Meadows “US Spec GP Grout”, US

Mix Co.

5. High Flow, Non-Metallic Grout: Use high-flow grout where high fluidity and/or increased placing time is required and for base plates that are larger than 10 square feet. The factory pre-mixed grout shall conform to ASTM C 1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non- Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 18" x 36" base plate. Provide one of the following: "Hi-Flow Grout," the Euclid Chemical Company "Masterflow 928," BASF Building Systems. "14K Hy Flow," BASF Building Systems “588 Grout”, W. R. Meadows “US Spec MP Grout”, US Mix Co.

AA. Frictionless Bearing Pads:

1. Types:

   a. Frictionless bearing pads shall be a nominal 3/32" glass filled virgin Tetrafluoroethylene (TFE) conforming to ASTM D 4745 with a 10 gauge A36 steel backing plate factory bonded with a tested epoxy performed in a heated bonding process under a controlled pressure. Provide one sliding pad tack welded to the lower supporting surface and one tack welded to the upper surface. Unless detailed otherwise on the drawings, the upper element shall be larger than the lower element on all sides by the amount of the expansion joint width shown on the drawings.

   b. The lower frictionless bearing pads shall be a nominal 1/16" glass filled virgin Tetrafluoroethylene (TFE) conforming to ASTM D 4745 with a 10 gauge A36 steel backing plate factory bonded with a tested epoxy performed in a heated bonding process under a controlled pressure. The upper frictionless bearing pad shall be a 20 gauge stainless steel sheet (RMS<20) resistance welded to a 10 gauge A36 steel backing plate. The lower sliding pad shall be tack welded to the lower supporting surface and the upper pad tack welded to the upper surface. Unless detailed otherwise on the drawings, the upper element shall be larger than the lower element on all sides by the amount of the expansion joint width shown on the drawings.

2. Design: The pad size and design shall conform to 1998 AASHTO "LRFD Bridge Design Specifications," Section 14. Design bearing pressure under total service load shall not exceed the manufacturer’s recommendation. If Neoprene is used the compressive load shall be limited to 800 psi.

3. Corrosion Resistance: Frictionless bearing pads for exterior or exposed

usage shall be manufactured for use in an exposed climate of heat, cold, moisture, and ultraviolet rays. All backing steel in an exposed or open environment shall be shop painted with a zinc rich paint or field painted with "ZRC Cold Galvanizing Compound".

4. Acceptable Manufacturers: The following manufacturers are acceptable:

   a. Con-Serv, Inc., Georgetown, SC
   b. Seismic Energy Co., Athens, TX

Other manufacturers will be acceptable only with Engineer approval prior to bid.

BB. Steel Fibers: Provide deformed cold-drawn wire or modified cold-drawn steel fibers meeting the requirements of ASTM A 820, types I or V, and that are listed as an acceptable product for use in the D900 series of UL Fire Rating Assemblies. The fibers shall have a minimum tensile strength of 145,000 psi when tested in accordance with ASTM A 370. The fibers shall have a minimum aspect ratio of 48. Acceptable products include:

“Dramix RC-65/60-BN” (Type 1), “Dramix RL45/50BN” (Type I), Dramix ZL60/1.05” (Type 1), Bekaert Corp.
“Novocon 1050” (Type I), Novocon 1050 HE” (Type I), or “Novomesh 850” (Type I), Propex Concrete Systems, Corp.
“MasterFiber FF or FS” series, BASF Construction Chemicals

CC. Synthetic Micro Fiber Reinforcement: Collated, fibrillated, or monofilament polypropylene, cellulose, or multi-filament nylon fibers conforming to ASTM C 1116, Type III or Type IV.

Products:

“Fiberstrand”, the Euclid Chemical Company "Econo-Mono" or “Econo-Net”; Forta Corp. "Fibermesh 300"; Propex Concrete Systems, Corp.
“Grace Microfibers” or “Grace Fibers”, W.R. Grace & Co. “Caprolan-RC”, Honeywell Nylon Inc.
“Nycon RC”, Nycon, Inc.
“UltraFiber 500”, Buckeye Technologies, Inc.
“MasterFiber M or F” series, BASF Construction Chemicals

DD. Synthetic Macro Fiber Reinforcement: Monofilament polypropylene/polyethylene fibers conforming to ASTM C 1116, Type III having an aspect ratio between 50 and 90 and a minimum tensile strength of 90 ksi. The fiber lengths shall be between 1.5 and 2 inches long.

Products:

“Tuf-Strand S.F.”, the Euclid Chemical Company “Forta-Ferro”, Forta Corp.
”Strux 90/40”, W.R. Grace
“Fibermesh 650”, Propex Concrete Systems, Corp. “Synmix”, Bekaert Corp.
“MasterFiber MAC” series, BASF Construction Chemicals

EE. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

FF. Carton Forms: Carton forms shall be manufactured using corrugated paper material with a moisture resistant exterior surface and specifically designed for foundation support. Carton forms shall be designed to support the wet weight of the concrete that is shown by the details to be poured on top of the form but not less than 600 psf. Refer to the Reinforced Concrete General Notes for the restriction on horizontal construction joints. The forms shall be designed in such a way that the bottom of the form will collapse when acted upon by upward movement of the soil.

1. Form Configuration: Carton forms shall be of a vertical cellular configuration only, except as permitted by item 4 below, and shall be rectangular as shown on the details. The depth of the carton forms is shown on the details. Forms shall be manufactured to fit snugly against round piers and shall be baffled in such a way as to prevent concrete from flowing back into the form during the concrete pour. The Contractor shall use expandable foam to fill all gaps and holes between carton forms and at intersections with foundations.

2. Carton forms shall be kept dry and protected until concrete is poured. Wet, compressed, or deteriorated carton forms shall not be used. Do not wrap or cover carton forms with polyethylene sheets or permanent waterproof cover as that will prevent proper deterioration of the forms.

3. Technical data and brochures on carton forms shall be submitted for Engineer's review.

4. Other types of forms using different types of paper and different configurations will be accepted if it can be shown by independent tests that the form will properly function and will deteriorate due to moisture in an appropriate time frame.

5. For slab conditions, cover carton forms with a 1/4 inch masonite protection cover board to prevent puncture and other damage during construction.

6. Products: Subject to requirements, acceptable manufacturers include but are not limited to the following:

SureVoid Products, Inc., Englewood, CO

GG. Contraction and Construction Joint-Filler Material for Slabs-on-Grade: Provide a 2- component semi-rigid, 100% solids epoxy having a minimum shore A hardness of 80 when tested in accordance with ASTM D 2240 and an elongation below 25% when measured in accordance with ASTM D 638. Subject to

compliance with requirements, provide one of the following:

"Euco 700", the Euclid Chemical Company
"Spec-Joint CJ"; Conspec Marketing and Manufacturing Co., Inc. "Masterfill 300 I", BASF Building Systems
“MM-80”, Metzger/McGuire Co. “Rezi-Weld Flex”, W. R. Meadows “US Spec SR-50 EJF”, US Mix Co.

HH. Bond breaker for Construction Joints in Slabs-on-Grade: A dissipating bond breaking compound containing no silicones, resins, or waxes, and that conforms to ASTM C 309. Subject to compliance with requirements, acceptable manufacturers include the following:

“Sure-Lift”, Dayton Superior Corporation, Inc.
“Tilt-Eez”, Conspec Marketing and Manufacturing Co., Inc.

II. Joint-Filler Strips for Isolation Joints in Slabs-on-Grade: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork. In post-tensioned slabs or shrinkage-compensated slabs, use compressible isolation-joint filler material that does not develop a stress greater than 25 psi at 50% strain when tested in accordance with ASTM D 1621 or D 3575.

JJ. Rigid-Cellular-Polystyrene Boards use as Fill under Topping Slabs or Slabs-on-Grade: Provide rigid, expanded (EPS) or extruded (XPS) cellular polystyrene boards that conform to ASTM D 6817 or ASTM C 578 with a minimum density of [Polystyrene Density] kg/m^3. Subject to compliance with requirements, acceptable manufacturers include the following:

“STYROFOAM Brand” Dow Chemical Company
“R-Control EPS Geofoam” - All grades, R-Control Building Systems “EPS Geofoam”, Carpenter Co.
“Knauf Geofoam”, Knauf Polystyrene “Insulfill”, Premier Industries

2.3 PROPORTIONING AND DESIGN OF CONCRETE MIXES

A. The Contractor shall submit concrete mix designs and the Concrete Mix Design Submittal Form located at the end of this specification section for each class of concrete indicated on the structural drawings and in the Specifications for approval by the Engineer and Owner's Testing Laboratory at least 15 working days prior to the start of construction,. If required, the Contractor shall engage the services of an independent Testing Laboratory to assist in preparing the mix design. The Contractor shall not begin work with a particular mix until that mix design has been approved.

B. Mix Design Conference: See the PREINSTALLATION CONFERENCES section of this specification.

C. The Contractor, acting in conjunction with his Concrete Supplier and his Testing Laboratory, shall submit in writing, with his mix designs, the method used to select mix proportions. Either of the following methods, as outlined in ACI 301, may be used.

1. Field Experience Method

2. Laboratory Trial Mixture Method

D. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings.

E. All mix designs shall state the following information:

1. Mix design number or code designation by which the Contractor shall order the concrete from the Supplier.

2. Structural slab or member for which the concrete is designed (i.e., columns, shear walls, footings, slab on grade, etc.).

3. Wet and dry unit weight.

4. 28-day compressive strength.

5. Aggregate type, source, size, gradation, fineness modulus.

6. Cement type and brand.

7. Fly ash or other pozzolan type and brand (if any).

8. Admixtures including air entrainment, water reducers, high-range water reducers, accelerators, and retarders.

9. Design Slump or Slump/Flow.

10. Proportions of each material used.

11. Water/cementitious ratio and maximum allowable water content.

12. Method by which the concrete is intended to be placed (bucket, chute, or pump).

13. Required average strength qualification calculations per ACI 301 4.2.3.3a and 4.2.3.3b. Submit separate qualification calculations for each production facility that will supply concrete to the project.

14. Documentation of Average strength (trial mix data or field test data) per ACI 301: When field test data is used to qualify average strength, submit separate documentation for each production facility that will supply concrete to the project.

15. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Labratory's reports from which the data was compiled.

16. All other information requested in the Concrete Mix Design Submittal Form located at the end of this specification section.

F. Low Alkali Concrete: For concrete identified on the drawings as exposed to exposure classes C1 and C2, the total alkali contribution from cementitious materials in the concrete mix shall not exceed 4.0 pounds per cubic yd of concrete unless the aggregate used is certified to contain no deleterious materials that react with alkalis in the concrete mix as defined in ASTM C 33. This requirement may be met by the use of low-alkali cement.

G. Supplementary Cementitious Materials: Fly ash and/or ground granulated blast-furnace slag replacement of Portland cement shall be within percentage replacement levels listed on the drawings unless noted otherwise. Every effort should be made to reduce the amount of cement to the minimum practical amount, and still achieve performance requirements contained in the Contract Documents.

1. Cement replacement shall not exceed a percentage level that has been shown by experience on other projects to exhibit satisfactory performance using materials from identical sources as proposed for this project. As an alternate, trial concrete batches can be performed to identify mix designs that maximize cement replacement while meeting strength requirements per ACI 318 Section 5.3 and finishability criteria.

2. The use of fly ash or slag in architecturally exposed structural concrete shall be coordinated with the Architect, Engineer of Record, and Contractor.

3. If fly ash is used, it must be at a minimum replacement percentage of 15%.

4. Overall replacement percentages with combined fly ash and slag shall not exceed the maximum identified with slag or be less than the minimum identified with fly ash for each type of element. In addition, the replacement percentage of fly ash within the combined mix shall not exceed the maximum identified with fly ash alone.

5. Replacement percentages exceeding the maximum may be permitted at the discretion of the Architect, Engineer of Record, and Contractor.

6. For concrete identified on the drawings as being subject to Exposure Class F3, the maximum amount of supplementary cementitious materials shall not exceed the limits noted in table 4.4.2 of ACI 318-08

7. Except for Mass Concrete, the Contractor may submit for approval a revised mix design with lower supplementary cementitious material percentages than herein specified should finishability or other issues arise due to changing weather conditions.

H. Aggregate: Comply with the following special requirements:

1. For exposed concrete, provide aggregates from a single source.

2. For exposed surfaces subject to Exposure Class C1 or C2, do not use aggregates containing spalling-causing deleterious substances.

3. For slabs and other designated concrete, combined aggregate gradation shall be 8% - 18% for large top size aggregates (1 1/2 in.) or 8% - 22% for smaller top size aggregates (1 in. or 3/4 in.) retained on each sieve below the top size and above the No. 100. Deviations from this gradation may be allowed upon the approval of the Engineer subject to the following limitations:

   a. The percent retained on two adjacent sieves shall be not less than 5%.
   b. The percent retained on three adjacent sieves shall be not less than 8%
   c. If the percent retained on two adjacent sieves is less than 8%, the total percent retained on either of those sieves and the adjacent outside sieve shall be not less than 13 %

I. Admixtures:

1. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Owner's Testing Laboratory and shall be used for the purpose intended by the manufacturer to produce concrete to meet the specified requirements.

2. Quantities of admixtures to be used shall be in strict accordance with the manufacturer’s instructions.

3. Air Content Requirements: For concrete subject to Exposure Class F1, F2 or F3 as noted on the drawings, use air-entrainment admixtures to provide concrete such that the air content at the point of delivery shall conform to the requirements of Table 4.4.1.of ACI 318-08 within plus or minus 1.5%. Required air content levels may be reduced by 1.0 percent for concrete strengths above 5000 psi.

   a. Interior steel troweled surfaces subjected to vehicular traffic shall not have more than 3% entrained air.
   b. Surfaces scheduled to receive hardeners shall not have more

than 3% entrained air.

c. Air-entraining admixtures are not permitted in industrial slabs.

4. Self-consolidating Concrete (SCC): Use where shown on the drawings. Proportion SCC mix with specified admixtures to produce a concrete having properties that allow it to flow freely into all spaces of the formwork, through tight openings under its own weight and is resistant to segregation during transport and placing. Flowable spread shall be between 20 to 30 inches and shall show no evidence of segregation, mortar halo, or aggregate pile, although some slight bleeding is acceptable. Workability, pumpability, finish, and setting time of the proposed mix design must be demonstrated by a successful trial placement onsite.

J. Lightweight Structural Concrete:

1. Comply with the requirements of ACI 211 and ACI 301.

2. Provide concrete with a dry unit weight of not more than 116 pounds per cubic foot and not less than 110 pounds per cubic foot. Design mix to produce strengths as indicated on the drawings with a split cylinder strength factor (fct/(f'c)0.5) of not less than 5.7.

K. Adjustments of Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such mix design adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved mix designs including changes in admixtures shall be submitted in writing with the specified Concrete Mix Design Submittal Form to the Engineer and Owner's Testing Laboratory for approval prior to field use.

L. Shrinkage: Concrete so identified on the drawings shall be proportioned for maximum allowable unit shrinkage as noted on the drawings, measured at 28 days after curing in lime water as determined by ASTM C 157 (using air storage). Submit results of test for each class of applicable concrete after every 500 CY placed.

M. Chloride Ion Content:

1. Unless noted otherwise, The maximum water soluble chloride ion concentration in hardened concrete measured at ages from 28 to 42 days contributed from all ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits specified in ACI 318-08 Table 4.3.1 depending on to which Corrosion Exposure Class (CO, C1 or C2) the concrete is subject as noted on the drawings. Water-soluble chloride ion tests shall conform to ASTM C 1218. One test shall be run for each class of concrete before the mix design submittal and each time a change is made to the mix design

(such as change in aggregate type or source).

2. The chloride ion content in all concrete used for prestressed or post-tensioned concrete shall not exceed .06 percent by weight of cement.

3. The Concrete Supplier shall certify on the Mix Design Submittal Form that the chloride ion content in all concrete mix designs used on the project does not exceed the limits stated above.

2.4 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, "Ready Mixed Concrete" and Testing Laboratory section of the specifications this specification .

PART 3 - EXECUTION

3.1 SLUMP LIMIT

A. The slump, as measured in the field where concrete cylinders are taken, shall be within plus or minus 1 inch of the design slump noted on the Mix Design Submittal Form. Self- consolidating concrete shall have a slump/flow of plus or minus 2 inches of the design slump noted on the Mix Design Submittal Form. Water may be added to the concrete in the field only to the extent that the prescribed water/cementitious ratio noted in the Mix Design Submittal Form is not exceeded.

3.2 VAPOR RETARDER INSTALLATION

A. Install vapor retarder in accordance with ASTM E 1643 and manufacturer's instructions.

B. Lap all seams 6" and seal all joints in the field with the specified pressure sensitive tape. Heat-welded joints done in a shop prior to delivery is an acceptable method to minimize the number of field joints.

C. Seal all pipe penetrations through the vapor retarder with a boot made from the vapor retarder material and tape.

3.3 JOINTS IN CONCRETE

A. Construction Joints: Locate and install construction joints as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer.

1. Keyways: Provide continuous keyways with a depth of one tenth of the member thickness (1 1/2" minimum or as shown on the drawings) in

construction joints only where shown on the drawings.

2. Joint Construction: Place construction joints in the center one third of suspended spans and grade beams and as shown on the drawings for slabs-on-grade and walls unless shown otherwise. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise shown on the drawings. Dowels that cross construction joints shall be supported during concreting operations so as to remain parallel with the slab or wall surface and at right angles to the joint. Submit all construction joint locations as a shop drawing submittal.

3. Waterstops: Provide waterstops in construction joints as indicated on the Architectural and Structural Drawings. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

4. Isolation Joints in Slabs-on-Ground: Construct isolation joints (without dowels) in slabs-on-ground at points of contact between slabs on ground and vertical surfaces only where specifically detailed on the drawings. Install joint-filler strips at joints where indicated. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated on the drawings. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together. Provide construction joints with dowels at all locations unless isolation joints are detailed.

5. Contraction joints in slabs-on-grade and unbonded topping slabs: Maximum joint spacing shall be 36 times the slab thickness or 20 feet, whichever is less and at a minimum on column lines unless otherwise noted on the drawings. Use one of the two following methods (sawed or formed) to create the joints. Do not use the formed joint in areas subject to vehicular traffic or in industrial slabs.

    a. Sawed Joints

        (1) Primary Method: Early-Entry, dry-cut method, by Soff-Cut International, Corona, CA (800) 776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 1 to 4 hours, depending on air temperature, after final finish as soon as the concrete surface is firm enough to not be torn or damaged by the blade at each saw cut location. Use 1/8 inch thick blade, cutting 1 1/4” inch into the slab.

(2) Optional Method (where Soff-Cut System method equipment is not available, subject to limitations): This method may not be used when there is no dowel passing through the contraction joint. Use a conventional saw to cut joints within 4 to 12 hours after finishing as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/8 inch thick blade, cutting to a depth of 1/4 of the slab thickness but not less than 1 inch. Cut to a depth of 1/3 slab thickness for slabs reinforced with steel fibers.

b. Formed Joints: Form contraction joints by inserting premolded plastic hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. The depth is to be 1/4 the slab thickness, but not less than 1 inch. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.

c. Joint Filler: Provide in both contraction and saw-cut construction joints when specified.

(1) Remove dirt and debris from the joint by vacuuming immediately prior to filling the joint. Clean the joint of curing compounds and sealers.

(2) Filler material shall be applied to the joints when the building is under permanent temperature control, but no less than 90 days after slab construction.

(3) Follow the manufacturer's recommended procedure for installing filler material. The joint filler must be flush with the adjacent concrete. A concave profile on the top of the joint filler is unacceptable and will be grounds for removal and replacement.

d. The Contractor shall protect the joints from damage caused by wheeled traffic or other sources during construction until a joint-filler material (if specified) has been installed.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto unless directed otherwise by these specifications. Install reglets to receive top edge of foundation sheet waterproofing where specified by the Architect, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles and other conditions.

B. Anchor Rods: Furnish anchor rods and other connectors required for securing

structural steel to foundations and other in-place work as shown on the drawings. Furnish 1/8" minimum steel templates for presetting rods and other anchors to accurate locations as shown on the drawings in keeping with the tolerances noted in ACI 117 for embedded anchor rods. Steel template shall be clearly marked with the following information:

1. Grid line intersection where template is to be used.

2. Orientation of the plate relative to the building grid lines.

3. “Top of Template” elevation.

4. Anchor rod projection above top of template.

C. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

D. Do not install sleeves and blockouts in concrete slabs, pier caps, footings or walls except where shown on the structural drawings or approved by the Architect and Engineer.

E. Securely fasten embedded plates, angles, anchor rods and other items to be built into the concrete to the formwork or hold in place with templates. Insertion of these items into concrete after casting is prohibited.

3.5 CONCRETE PLACEMENT

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

C. Comply with ACI 301 and as herein specified.

1. Concrete Temperature: The maximum acceptable concrete temperature at the truck discharge point shall be 95 °F.

2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein

specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Spread concrete using short-handled, square-ended shovels, or come-alongs.

3. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use internal vibrators of the largest size and power that can properly be used in the work as described in the table entitled “Range of characteristics, performance, and applications of internal vibrators” found in ACI 301.

5. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

6. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs. Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least one hour.

7. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners of forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.

8. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats or darbies to smooth surface free of humps or hollows before excess moisture or bleedwater appears on the surface. Do not disturb slab surfaces prior to beginning finishing operations.

9. Maintain reinforcing in proper position during concrete placement operations.

10. Placing Concrete by Pump: If concrete is placed by using a pump, the grout used for pump priming must not become a part of the

completed structure unless an engineered grout design mix and grout location are approved in advance by the Engineer.

3.6 FINISH OF FORMED SURFACES

A. General: Formed surfaces shall have the finishes as described below and as shown on the drawings after formwork is removed and repairs made.

B. Matching Sample Finish: Finish on surfaces at locations noted on drawings shall match sample panel furnished to Contractor. Reproduce finish on a 100 square foot mock-up panel in a location designated by Architect/Engineer. Protect mock-up from damage for the duration of project. Approval of mock-up by Engineer is required before proceeding with application of finish in project.

C. Definitions and Finish Requirements

1. Surface Finish 1.0 (SF-1.0):

a. No formwork facing material is specified
b. Patch voids larger than 1-1/2 in. wide or 1/2 in. deep
c. Remove projections larger than 1.0 inch.
d. Provide surface tolerance Class D as specified in ACI 117
e. Tie holes need not be patched

2. Surface Finish 1.1 (SF-1.1):

a. No formwork facing material is specified
b. Patch voids larger than 1 in. wide or 1/2 in. deep
c. Remove projections larger than 1/2 inch.
d. Provide surface tolerance Class C as specified in ACI 117
e. Tie holes need not be patched

3. Surface Finish 2.0 (SF-2.0):

a. Provide specified formwork-facing material
b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
c. Patch tie holes
d. Remove projections larger than 1/4 in.
e. Provide surface tolerance Class B as specified in ACI 117
f. Provide mock-up of concrete surface appearance.

4. Surface Finish 2.1 (SF-2.1):

a. Provide specified formwork-facing material
b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
c. Patch tie holes
d. Remove projections larger than 1/4 in.

e. Provide surface tolerance Class B as specified in ACI 117
f. Provide specified rubbed finish after formwork removal
g. Provide mock-up of concrete surface appearance.

5. Surface Finish 2.2 (SF-2.2):

a. Provide specified formwork-facing material
b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
c. Patch tie holes
d. Remove projections larger than 1/4 in.
e. Provide surface tolerance Class B as specified in ACI 117

6. Surface Finish 2.3 (SF-2.3):

a. No formwork-facing material is specified
b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
c. Patch tie holes
d. Remove projections larger than 1/4 in.
e. Provide surface tolerance Class B as specified in ACI 117

7. Surface Finish 3.0 (SF-3.0):

a. Provide specified formwork facing material
b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
c. Remove projections larger than 1/8 inch.
d. Patch tie holes
e. Provide surface tolerance Class A as specified in ACI 117
f. Provide mock-up of concrete surface appearance.

8. Surface Finish 3.1 (SF-3.1):

a. Provide specified formwork-facing material
b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
c. Patch tie holes
d. Remove projections larger than 1/8 in.
e. Provide surface tolerance Class A as specified in ACI 117

f. Provide specified rubbed finish after formwork removal
g. Provide mock-up of concrete surface appearance.

9. Surface Finish 3.2 (SF-3.2):

a. Provide specified formwork-facing material
b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
c. Patch tie holes
d. Remove projections larger than 1/8 in.
e. Provide surface tolerance Class A as specified in ACI 117

10. Surface Finish 3.3 (SF-3.3):

a. No formwork-facing material is specified
b. Patch voids larger than 3/4 in. wide or 1/2 in. deep
c. Patch tie holes
d. Remove projections larger than 1/8 in.
e. Provide surface tolerance Class A as specified in ACI 117

D. Standard Finish: Provide SF-1.0 on all concrete surfaces not exposed to view in the final condition unless otherwise specified.

E. Exposed Finishes: Provide SF-2.0 on all concrete surfaces exposed to view in final condition unless otherwise specified.

F. Rubbed Finishes: Remove forms as early as permitted by these specifications and perform any necessary repairs and patches.

1. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled or specified concrete surfaces which have received smooth-form finish treatment, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

2. Grout Cleaned Finish: Provide grout cleaned finish to scheduled or specified concrete surfaces that have received smooth-form finish treatment.

a. Combine one part portland cement to 1-1/2 parts sand meeting the requirements of ASTM C144 and C404 by volume, and 50:50 mixture of acrylic or styrene butadiene based bonding admixture and water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement,

amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

b. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

3. Cork-floated Finish: Provide cork-floated finish to scheduled or specified concrete surfaces that have received smooth-form finish treatment.

a. Combine one part portland cement to one part sand meeting the requirement of ASTM C144 or C404, by volume and water and mix to a to consistency of thick paint. Apply stiff to a wet surface, compressing the grout into all voids.

b. Produce the final finish with a cork float using a swirling motion.

G. Self-Consolidating Concrete Architectural Finish: Use self-consolidating concrete where shown on the plans to produce a smooth, uniform finish upon form removal with no patching, stoning, rubbing or other form of repair, except washing, permitted. The surface shall match the approved jobsite test panel.

H. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 MONOLITHIC SLAB FINISHES

Place, consolidate, strike off, and level concrete, eliminating high spots and low spots, before proceeding with any other finish operation. Do not add water to the surface of the concrete during finishing operation.

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerance specified below. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for

floating. Begin floating, using a hand float, a bladed power float equipped with float shoes, or a powered disk float, when the bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit the operation. Check and level surface plane to a tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system. After floating, begin first trowel finish operation by hand or power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand- troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface to a tolerance as specified below. Grind smooth surface defects which would telegraph through applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin- set mortar, apply initial trowel finish as specified above, then immediately follow with slightly scarifying surface by fine brooming.

E. Slip-Resistive Broom Finish: Apply slip-resistive broom finish to garage floors and ramps less than 6% slope, exterior concrete platforms, steps and ramps and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Roller-Bug Finish: Provide a roller-bug finish with minimum ¼" amplitude to all ramps exceeding a 6% slope. Extend the finish as least 12 feet beyond the beginning and ending of the greater-than-6% ramp. The finish shall be imprinted on the concrete by the use of a roller-bug tamper.

G. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Apply proprietary chemical hardeners, in strict accordance with manufacturer's printed instructions.

After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

H. Liquid Sealer/Densifier Finish: Apply liquid sealer/densifier finish to exposed interior concrete floors where indicated. Apply liquid sealer/densifier after complete curing and drying of the concrete surface and in strict accordance with manufacturer's printed instructions.

I. Penetrating Sealer Finish: Apply a chloride-and-water-repelling-penetrating-sealer finish to surfaces as described below and where indicated on the

drawings. Apply liquid penetrating sealer after complete curing and drying of the concrete surface. Apply proprietary sealers in strict accordance with manufacturer's printed instructions. The Contractor shall verify the compatibility of the sealer product with the paint used to stripe parking decks and coordinate the sequencing of the sealing and striping operations. Apply to the following surfaces:

1. Sloping and horizontal surfaces of parking garages

2. Top surfaces of exposed exterior balconies

J. Slip-Resistive Aggregate Finish: Apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps and elsewhere as indicated on the Architect's or Structural Drawings.

After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened slip-resistive aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose slip-resistive aggregate.

K. Colored, Mineral Aggregate Surface Hardener: Provide colored, mineral aggregate surface hardener to monolithic slab surface indicated.

Apply dry shake materials for colored wear-resistant finish at rate of not less than 100 lbs. per 100 sq. ft., unless greater amount is recommended by material manufacturer.

Cast a trial slab approximately 20 feet square to determine actual application rate, color and finish as acceptable to Architect/Engineer.

Immediately following first floating operation, uniformly distribute approximately 2/3 of required weight of dry shake material over concrete surface, and embed by means of power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material at right angles to first application, and embed by power floating.

After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

L. Non-Oxidizing Metallic Floor Hardener: Slabs in areas noted on the drawings shall receive an application of the non-oxidizing, metallic floor hardener applied at the rate of

150 lbs. Per 100 sq. ft. Immediately following the first floating operation, uniformly distribute approximately 2/3 of the required weight of the hardener over the concrete surface by mechanical spreader and embedded by means of power floating. The hardener shall be floated in and the second application made. The surface shall be floated again to properly bond the hardener to the base concrete

slab. The surface shall then be troweled at least twice to a smooth dense finish.

M. Metallic Aggregate Floor Hardener: Slabs in areas noted on the drawings shall receive an application of the metallic aggregate floor hardener applied at the rate of 150 lbs. Per 100 sq. ft. Immediately following the first floating operation, uniformly distribute approximately 2/3 of the required weight of the hardener over the concrete surface by mechanical spreader and embedded by means of power floating. The hardener shall be floated in and the second application made. The surface shall be floated again to properly bond the hardener to the base concrete slab. The surface shall then be troweled at least twice to a smooth dense finish.

N. Finish of Top of Spread Footings and/or Mat Foundations:

1. Top Surface below Finished Slab: The top of the footing or mat shall be screeded level and smooth with a flatness F-number, FF15 (overall), FF10 (minimum local) and a levelness F-number, FL12 (overall), FL10 (minimum local).

2. Top Surface as Finished Slab: The top surface of a footing or mat that is to serve as the finished slab in the building shall be leveled cured, and surface prepared as specified for the finished floor construction appropriate to the space usage as defined in the Architectural Drawings.

3.8 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. Testing Procedure: ASTM E 1155

B. Tolerance on Floor Elevations: Construction tolerance on absolute floor elevation from the specified elevation as shown on the drawings shall be as specified below, taken from ACI 117:

1. Slab-on-Grade Construction - ± 3/4".

2. Top surfaces of formed slabs measured prior to removal of supporting shores -

± 3/4".

3. Top surfaces of all other slabs - ± 3/4".

C. Random Traffic Floor Finish Tolerances:

1. Specified overall values for flatness (SOFF) and levelness (SOFL) shall conform to the values listed below for the floor surface classification noted for each slab category noted.

Floor Surface Classification	SOFF	SOFL
Conventional	20	15
Moderately Flat	25	20
Flat	35	25
Very Flat	45	35
Super Flat	60	40

2. Minimum local values for flatness (MLFF) and levelness (MLFL) shall equal 3/5 of the SOFF and SOFL values, respectively, unless noted otherwise. The MLFF and MLFL values shall apply to the minimum areas bounded by the column lines and half-column lines, or the minimum areas bounded by the construction and contraction joints, whichever are the smaller areas.

3. The SOFL and MFLL tolerance values shall apply only to level slabs-on-ground or to level, uncambered suspended slabs that are shored such that it cannot deflect from the time the floor is placed to the time it is measured.

4. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10 feet at any point.

D. Construction Requirements to Achieve Specified Floor Finish Tolerances:

1. Forms shall be properly leveled, in good condition and securely anchored including special attention to ends and transitions.

2. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.

3. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicate substandard work.

4. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations.

E. Contractor Responsibility for Concrete Floor Finish Requirements: Floor finish requirements shown below (flatness and levelness tolerances) are minimum requirements that apply unless stricter requirements are contained in instructions for installation of applied floor products in which case the Contractor is responsible for attaining the values prescribed by the manufacturer of such products.

F. Concrete Floor Finish Tolerance for Slab-on-Grade Construction:

1. Concrete Placement: Concrete shall be placed and screeded to predetermined marks set to elevations prescribed on the drawings.

2. Finish Tolerances of Random Traffic Floor Surfaces:

a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional
b. Carpeted Areas: Moderately Flat
c. Industrial Slabs: Moderately Flat
d. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat
e. Ice or Roller rinks: Very Flat
f. Movie or Television studios: Super Flat
g. Gymnasium Floors Scheduled to Receive Wood Playing Floor: Very Flat

G. Concrete Floor Finish Tolerance for Shored, Cast-in-Place Suspended Slab Construction:

1. Concrete Placement: Formwork shall be set and securely braced so that soffits are positioned to allow scheduled concrete member sizes and thicknesses within tolerances specified in ACI 117. Concrete shall be placed and screeded to predetermined marks on the form surface conforming to elevations prescribed on the drawings.

2. Camber: Formwork camber, as indicated on the drawings, shall be set to provide a uniform, smooth soffit profile in each direction. Minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface to a tolerance as specified in ACI 117. Tolerance on camber shall be $\pm$ 1/4". Levelness F-Number tolerances specified below does not apply to areas of the floor where camber or intentional slope is shown.

3. Finish Tolerances of Random Traffic Floor Surfaces:

a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set

tile or a topping, and parking structures: Conventional

b. Carpeted Areas: Moderately Flat

c. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat

d. Movie or Television studios: Super Flat

4. Extra Concrete: The contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance.

5. Concrete Placement at Column Bays Supported by unshored transfer girders: Concrete in floor areas supported by unshored transfer girders shall be placed and screeded to predetermined marks placed over the slab conforming to elevations as specified on the drawings. At least the minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface. The Contractor shall conform to the FF values specified above.

H. Concrete Floor Finish Tolerance - Unshored Metal Deck on Shored or Unshored Steel Beam or Open-Web Joist Floor Construction:

1. Concrete Placement: Concrete over metal deck shall be placed and screeded level and flat to the tolerance specified below, maintaining at least the minimum slab thickness at all locations as specified on the drawings. The Contractor shall increase the slab thickness as required to compensate for metal deck deflection, and in unshored beam construction, residual beam camber and beam deflection in order to achieve a level and flat floor within specified tolerances.

2. Finish Tolerance of Random Traffic Floor Surfaces:

a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional

b. Carpeted Areas: Moderately Flat

c. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat

d. Movie or Television studios: Super Flat

e. Eighty percent (80%) of the final floor surface shall fall within an envelope of 0.75" centered about the mean elevation of all the readings. (± 0.375 about mean). The mean elevation of all readings shall not deviate from the specified design grade by more than ± 0.375".

3. Extra Concrete: The contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance and to compensate for metal deck deflection, beam camber and beam deflection.

4. Concrete Placement at Column Bays Supported on Transfer Girders or Trusses: Concrete in floor areas supported by transfer girders or trusses shall be placed and screeded to predetermined marks placed over the metal deck slab conforming to elevations as specified on the drawings. At least the minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface. The Contractor shall conform to the FF values specified above.

I. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:

1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:

   a. The composite overall values of FF or FL of the entire floor installation measure less than specified values.
   b. Any individual test section measures less than the specified absolute minimum FF or FL value.

2. Modification of Existing Surface:

   a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.
   b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair and time to affect the repair.
   c. Repair method(s), at the sole discretion of the Architect/Engineer or Owner's Representative, may include grinding (floor stoning), planing, retopping with self leveling underlayment compound or repair topping, or any combination of the above.
   d. The Architect/Engineer or Owner's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Architect/Engineer or Owner's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.

   e. The judgment of the Architect/Engineer or Owner's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.
   f. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3. Removal and Replacement:

a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.

b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.

c. Sections requiring replacement shall be removed by sawcutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.

d. The new section shall be reinforced the same as the removed section and doweled into the existing floor as required by the Engineer. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.

e. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.

f. The judgment of the Architect/Engineer or Owner's Representative on the need for replacement shall be final.

g. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3.9 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete. Limit moisture loss to a maximum of 0.05 lb. /sq. ft – hr for concrete containing silica fume and 0.2 lb. /sq. ft. - hr for all other concrete before and during finishing operations.. If using an evaporation retarder, apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be 7 days for all concrete except high early strength concrete which shall be cured for 3 days minimum.

Alternatively, curing times may be reduced if either of the following provisions is complied with:

a. If tests are made of cylinders kept adjacent to the structure and cured by the same methods, curing measures may be terminated when the average compressive strength has

reached 70% of the specified 28 day compressive strength.

b. If the temperature of the concrete is maintained at a minimum of 50°F for the same length of time required for laboratory cured cylinders of the same concrete to reach 85% of the 28 day compressive strength, then curing may be terminated thereafter.

3. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period.

B. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by one or a combination of the methods specified below, as applicable.

1. Columns and shearwalls that are not exposed to view: Moist cure in forms or by one or a combination of methods 1, 2, or 3 specified below. Use a high –solids, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, type I, Class A or B for method 3.

2. Columns and shearwalls that are exposed to view: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a high-solids, non- yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, type 1, class A for method 3.

3. Sides and Soffits of Beams and Pan-Joist Ribs, Soffits of Slabs: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

4. Basement Walls, Sides of Exterior Retaining Walls: Moist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a liquid membrane- forming dissipating resin curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

C. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping and other flat surfaces by one or a combination of the methods specified below, as applicable. The Contractor shall choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface.

1. Ramps and Horizontal Surfaces of Parking Areas, Exposed Exterior Balconies: Cure using only methods 1 or 2 as specified below.

2. Floors Directly Exposed to Vehicular or Foot Traffic not in Parking Areas and not otherwise receiving a chemical hardener or penetrating sealer finish: Apply two coats of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, type 1, Class A in accordance with method 3 as specified below.

3. Floors in Non-Public spaces that are left exposed to view and not receiving sealers or hardeners, floors involved in under-floor air distribution systems: Apply one coat of a high-solids, water-based, non-yellowing, liquid membrane- forming curing and sealing compound conforming to ASTM C 1315, type 1, Class A or B in accordance with method 3 as specified below.

4. Floors that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, acrylic terrazzo, vinyl composition tile, sheet vinyl, linoleum, vinyl- backed carpet, rubber, athletic flooring, synthetic turf, wood, epoxy overlay or adhesive, or other coating or finishing products: Cure using methods 2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

5. Industrial Slabs: Cure using methods 1 or 2 as specified below for 7 days. The temperature of applied water shall be with 10° F of concrete surface temperature.

6. All Other Surfaces: Cure using methods 1, 2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, type 1, class A or B for method 3.

D. Curing Methods:

1. Method 1 - Moisture Curing: Provide moisture curing by one of the following methods:

   a. Keep concrete surface continuously wet by covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

2. Method 2 - Moisture-Retaining Cover Curing: Provide moisture-retaining cover curing as follows:

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable

width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Water may be added to concrete surface to prevent drying before the cover is installed, but the surface shall not be flooded with water if a non-absorptive cover is used.

3. Method 3 – Curing or Curing and Sealing Compound: Provide curing, curing/hardener, liquid membrane-forming curing, or curing and sealing compound as follows:

Apply specified compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Do not allow to puddle. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Apply second coat for sealing 2 to 3 hours after the first coat was applied.

Do not use membrane-forming curing and sealing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glued-down carpet, vinyl composition tile, linoleum, sheet vinyl, rubber, athletic flooring, synthetic turf, or wood), paint or other coatings and finish materials. Dissipating resin type cures are acceptable in these locations.

3.10 HOT WEATHER CONCRETING

A. Definition:

1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. If conditions cause an evaporation rate of 0.2 lb. /sq. ft. /hr. as calculated by Figure 2.1.5 in ACI 305R-99, then precautions shall be taken to prevent plastic shrinkage cracks from occurring.

B. Specification: Follow hot weather concreting practices specified below when required to limit the concrete temperature at the truck discharge point to the stated maximum acceptable temperature.

C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.

D. Hot Weather Concreting Requirements: The following items, all or in part as required, shall be followed to limit the concrete temperature to the stated maximum acceptable temperature and to minimize the possibility of plastic shrinkage cracks from developing.

1. Design the concrete mixes specifically for hot weather conditions

replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).

2. Use the largest size and amount of coarse aggregate compatible with the job.

3. Use sunshades and/or windbreaks.

4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.

5. Cool and shade aggregate stockpiles.

6. Use ice as part of the mixing water or cool the water with liquid nitrogen.

7. Limit the number of revolutions at mixing speed to 125 maximum.

8. Reduce time between mixing and placing as much as possible.

9. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.

10. Schedule concrete placement for early morning, late afternoon, or night.

11. Have all forms, equipment and workers ready to receive and handle concrete.

12. Maintain one standby vibrator for every three vibrators used.

13. Keep all equipment and material cool by spraying with water including exteriors of forms, reinforcing steel, subgrade, chutes, conveyors, pump lines, tremies, and buggies.

14. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the Owner's Testing Laboratory.

15. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 1315. Continue curing for 3 days minimum.

16. Cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature immediately before placement of concrete.

17. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.

3.11 COLD WEATHER CONCRETING

A. Definition:

1. Concrete shall not be placed when the outside air temperature is 40°F or less unless cold weather concreting practices are followed as specified below.

2. Cold weather concreting practices should also be followed whenever the average daily air temperature is expected to be less than 40°F for more than three successive days. The average daily air temperature is the average of the highest and lowest temperature occurring during the period from midnight to midnight. The requirement for adhering to these cold-weather concreting practices may be terminated when the air temperature is above 50º F for more than half of any 24 hour duration.

3. Cold-weather concreting practices invoked shall keep the temperature of the concrete immediately after placing within the following temperature ranges:

   a. 55º to 75º F for sections less than 12 in. in the least dimension
   b. 50º to 70º F for sections 12 to 36 in. in the least dimension
   c. 45º to 65º F for sections 36 to 72 in. in the least dimension
   d. 40º to 60º F for sections greater than 72 in. in the least dimension

4. Concrete Protection: Protect the concrete immediately after placing and during the defined protection period such that the concrete does not freeze nor fall below the temperature levels stated in the above paragraph. For concrete not loaded during construction the protection period shall be for a minimum of three days if cold-weather conditions persist. The time period may be reduced to a minimum of two days if Type III cement or an accelerating admixture is used or if an additional 100 pounds of cement per cubic yard is added to the concrete mix. Concrete fully loaded during construction shall be protected during cold weather conditions for whatever time period is required to obtain the required strength as determined by nondestructive strength tests (Windsor probe, Swiss Hammer Test) on the in-place concrete. Protect concrete surfaces from freezing for the first 24 hours even if cold-

weather conditions do not officially exist due to high volatility in ambient temperatures.

5. Protection Deficiency: If the temperature requirements during any portion of the protection period are not met but the concrete surface did not freeze, the protection period shall be extended until twice the deficiency expressed in degree-hours is made up. Deficiency degree-hours are defined as the average deficiency in temperature below the required value times the number of hours the deficiency persisted. Make-up degree hours are the average increase in temperature above the minimum value times the hours required to make up twice the deficiency degree-hours. Contact the Architect/Engineer if the concrete surface was allowed to freeze during the protection period.

6. Protection Removal: As the protection is being removed the decrease in temperature measured at the surface of the concrete in a 24 hour period shall not exceed the following:

    a. 50º F for sections less than 12 in. in the least dimension
    b. 40º F for sections 12 to 36 in. in the least dimension
    c. 30º F for sections 36 to 72 in. in the least dimension
    d. 20º F for sections greater than 72 in. in the least dimension

7. The maximum concrete temperature heated by artificial means at point of placement shall not exceed 90°F.

B. Records: Under cold weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature as placed and general weather conditions. The temperature record shall be taken no less than 2 times per 24 hour duration.

C. Cold Weather Concreting Requirements: The following items, all or in part as required, should be followed to assure acceptable concrete in cold weather conditions:

1. Design the concrete mix to obtain high early strength by using higher cement content, a high early strength cement (Type III), or a specified non-chloride accelerator (ASTM C 494 Type C or E).

2. Protect the concrete during curing period using insulating blankets, insulated forms, enclosures and/or heaters.

3. Concrete cured in heated enclosures shall have heaters vented to prevent exposure of concrete and workmen to noxious gases.

4. Frozen subgrade shall be thawed prior to concrete placement and snow and ice shall be removed from forms.

5. Temperature of embedments in concrete must be heated to above 32° F prior to placing concrete

6. Heat the mixing water and then blend hot and cold water to obtain concrete no more than 10°F above the required temperature.

7. Heat the aggregates by circulating steam in pipes placed in the storage bins for air temperatures consistently below 32°F. When either water or aggregate is heated to over 140°F combine them in the mixer first to obtain a maximum temperature of the mixture not to exceed 140°F in order to prevent flash set of the concrete.

8. Uniformly thaw aggregates far in advance of batching to prevent moisture variations in the stockpile.

9. Cover warmed stockpiles with tarps to retain heat.

10. Place air entraining admixture in the batch after the water temperature has been reduced by mixing with cooler solid materials.

11. Use wind screens to protect concrete from rapid cooling.

12. Place vertical pump lines inside the building, if possible, for concrete being pumped.

13. Maintain artificial heat as low as possible to reduce temperature stresses during cooling.

14. Avoid water curing of concrete except for parking garage structures. Apply the required curing compound to unformed surfaces as soon as possible to prevent drying of concrete from heated enclosures.

15. Delay form stripping as long as possible to help prevent drying from heated enclosures and to reduce damage to formed surfaces caused by premature stripping.

16. Provide triple thickness of insulating materials at corners and edges vulnerable to freezing.

17. Wrap protruding reinforcing bars with insulation to avoid heat drain from the warm concrete.

18. Gradually reduce the heat at the end of the heating period to reduce likelihood of thermal shock.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of

work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor rods for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Grout base plates and foundations as indicated, using specified non-shrink, non-metallic grout. Use high-flow grout where high fluidity and/or increased placing time are required. This grout shall be used for all base plates larger than 10 square feet.

E. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and finish concrete surfaces as scheduled.

F. Installation of adhesive anchors using injectable epoxy or adhesive: A representative of the adhesive manufacturer shall be present for the first day that adhesive anchors are installed. After drilling the hole to the diameter and depth recommended by the manufacturer, clean the hole with a wire or nylon brush. Blow the dust out of the hole using compressed air with a nozzle that reaches to the bottom of the hole. When using adhesive from a new pack, the adhesive that is discharged from the mixing nozzle should be a uniform gray color before any adhesive is installed in the hole. Fill the hole with adhesive starting from the very bottom of the hole until the hole is about 2/3 full. Do not leave an air pocket at the bottom of the hole. Insert the anchor rod or dowel by slowly twisting it into the hole.

3.13 CONCRETE SURFACE REPAIRS

A. Definition - Defective Areas:

1. Formed Surfaces: Concrete surfaces requiring repairs shall include all cracks in excess of 0.01" and any other defects that affect the durability or structural integrity of the concrete. Voids, including honeycombing and rock pockets, and tie holes shall be repaired as required by the specified Surface Finish.

2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface defects such as crazing, cracks in excess of 0.01" wide or cracks which penetrate to reinforcement or through the member, popouts,

spalling and honeycombs.

B. Classification:

1. Structural Concrete Repair: Major defective areas in concrete members that are load carrying (such as shear walls, beams, joists and slabs), are highly stressed, and are vital to the structural integrity of the structure shall require structural repairs. Structural concrete repairs shall be made using a two-part epoxy bonder, epoxy mortar or specified polymer repair mortar. The Engineer shall determine the locations of required structural concrete repairs.

2. Cosmetic Concrete Repair: Defective areas in concrete members that are non- load carrying and minor defective areas in load carrying concrete members shall require cosmetic concrete repair when exposed to view and not covered up by architectural finishes. Cosmetic concrete repairs may be made using a polymer repair mortar and compatible bonding agent. The Architect/Engineer shall determine the locations of required cosmetic concrete repairs. Stains and other discolorations that cannot be removed by cleaning and are exposed to view will require cosmetic repair. Cosmetic concrete repair in exposed-to-view surfaces will require Architect's approval prior to patching operation.

3. Slab Repairs: High and low areas in concrete slabs shall be repaired by removing and replacing defective slab areas unless an alternate method, such as grinding and/or filling with self-leveling underlayment compound or repair mortar is approved by the Architect/Engineer. Repair of slab spalls and other surface defects shall be made using epoxy products as specified above and as determined by the Engineer. The high strength flowing repair mortar may be used for areas greater than 1 inch in depth.

3.14 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for concrete materials and cast-in-place concrete inspection and test requirements.

END OF SECTION 03 30 00

SECTION 31 1000
SITE CLEARING

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 SECTION INCLUDES

A. Clearing of site.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Division 31 Section "Grading".
B. Division 31 Section "Excavation and Fill for Utilities".
C. Division 31 Section "Excavation and Fill for Structures".
D. Division 32 Section “Site Concrete Work”.

1.04 DEFINITIONS

A. Clearing: Removal of trees, shrubs, bushes, and other organic matter found at or above original ground level.

B. Grubbing: Removal of stumps, roots, boards, logs, and other organic matter found at or below original ground level.

C. Topping: Removal of those portions of trees, bushes, and shrubs projecting above an elevation or plane shown or indicated on Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide all materials, equipment, and appurtenances required for completion of clearing work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces for conditions that will adversely affect execution, permanence, and quality of work of this Section.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 PROTECTION

A. Public and Adjacent Properties: Protect in accord with applicable laws and ordinances. Existing on-site features, including flora scheduled to remain: Protect from damage at all times.

1. Do not allow earth-moving equipment within the branch spread perimeter (drip line) of existing trees which are to remain.
2. Do not impact, trespass upon, or otherwise violate areas designated on Drawings as easements, buffer zones, wetlands, or similar environmentally-sensitive areas.
3. Protect existing piezometers and monitoring wells located on-site which have been identified and flagged by Owner.

B. Utilities:

1. Protect all active utility lines on-site.
2. Remove from site abandoned lines encountered during clearing and grubbing operations.
3. Capping and/or rerouting of active utility lines encountered during clearing and grubbing operations shall be performed as part of the work of other Sections.
4. Expeditiously repair damaged utilities at no cost to Owner.

C. Dust control:

1. Throughout entire construction period, effectively dust-palliate working area, unpaved roads, and involved portions of the site.
2. Palliation: Intermittently water and sprinkle with such frequency as will satisfactorily allay dust at all times. Chemical treatment of any type is not permitted.
3. Use of reclaimed water shall conform to requirements and guidelines of governing health authorities and be specifically approved by Owner.

D. Soil redistribution: Do not redistribute existing soils beyond immediate area of origin.

3.03 CLEARING

A. Limit of Clearing: Areas indicated on Drawings. Clearing limits shall be approved by Owner prior to starting clearing operations.

B. Remove trees, saplings, shrubs, bushes, vines, and undergrowth within limits of clearing.

3.04 GRUBBING

A. Limits of grubbing: As specified for clearing.

B. Remove tree stumps and root systems completely, unless removal damages roots of plants to remain. Refer to Division 31 Section "Excavation and Fill for Utilities" for protection of existing plants to remain.

C. For vegetation other than trees, remove stumps, roots, and matted roots to depths specified below:

1. Under footings: 18 inches.

2. Under walks: 12 inches.
3. Under roads: 18 inches.
4. Under parking areas: 12 inches.
5. Under planting areas: 12 inches. Under fills: 8 inches.
6. Where footings, roads, walks, and other construction is on fill, the greater depth applies.

3.05 DISPOSAL

A. Burning of materials on-site is not permitted.

B. Removal:

1. Remove materials resulting from clearing and grubbing operations from site daily as they accumulate.
2. When work continues beyond normal working hours, do not allow materials to accumulate on-site for more than 48 hours.

3.06 TREE REMOVAL, RELOCATION, OR SALVAGE

A. Protect trees to remain from damage (see tree preservation notes on planting plan).

B. Cut and remove other trees including stumps, from site unless designated on Drawings to remain or be relocated.

C. Verify with Owner which trees are to be salvaged, removed, or relocated.

-END OF SECTION -

SECTION 31 2200
GRADING

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 SECTION INCLUDES

A. Site grading, including:

1. Site stripping.
2. Removal of organic soils.
3. Import or export of soils as required to complete grading.
4. Rough grading and shaping of site.
5. Final finish grading and shaping of site.
6. Groundwater control and dewatering of excavations.
7. Removal from site and proper disposition of all debris and excess material resulting from the work.
8. Fill and compact holes resulting from removals.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Geotechnical Report.

B. Division 31 Section "Site Demolition".

C. Division 31 Section "Excavation and Fill for Utilities".

D. Division 31 Section "Excavation and Fill for Structures".

E. Division 31 Section "Erosion and sedimentation controls".

F. Division 32 Section “Site Concrete Work”.

1.04 DEFINITIONS

A. Dewatering: Control of surface water runoff and ground water accumulation.

1.05 QUALITY ASSURANCE

A. Tests and Inspections:

1. Procedure: In accordance with Division 01 Sections.
2. Required tests:

a. Fill material: Determine suitability of fill material not previously evaluated.
b. Maximum density tests: Determine optimum moisture content and maximum dry density of fill materials placed and compacted in accord with ASTM D 1557, Procedure A.

c. Field density tests: Determine in-place density of fill materials placed and compacted in accord with ASTM D 1556, ASTM D 2922, or ASTM D 2937. Provide one test for every 10,000 sq. ft. per lift.
d. Certification of all subgrade improvements and engineered fills and subgrades with respect to their adequacy and suitability values for intended uses.
e. Suitability and classification testing for all soils of unknown characteristics prior to use as compacted fills.
f. Other tests as may be required by Owner.

3. Required inspections and controls:

a. General inspection of stripping of surfaces and removal of root mat, peat, organic soils (muck), clay, and other unsuitable material.
b. Detailed inspection of exposed subgrades prior to finishing or placing fill materials.
c. Continuous control of placing and compacting of all engineered fills.
d. Continuous inspection and monitoring during placing and compacting operations.
e. Observation and consultation in processes of bank shaping, safety in excavations, dewatering, and identification of materials encountered.

B. Requirements of regulatory agencies: In addition to complying with other legal requirements, comply with the following.

1. Code of Federal Regulations Title 29 CFR Part 1926, Subpart P, Excavations.
2. Occupational Safety and Health Administration Document 2226.

C. Reference specifications and standards:

1. ASTM: D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM: D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lbf/ft3).
3. ASTM: D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
4. ASTM: D 2937 Density of Soil In-Place by the Drive-Cylinder Method.
5. CFR: Title 29 CFR Part 1926 Safety and Health Regulations for Construction.
6. OSHA: Document 2226 Excavations.

D. Allowable tolerances:

1. Grading elevations and contours: Accuracy of final grading elevations and contour shall be the responsibility of a civil engineer or land surveyor licensed in the State of California.
2. Grade (cut or fill) site to the elevations indicated on Drawings within the following tolerances:

a. All cuts and fills: Within a tolerance ±0.10 feet for grades indicated on Drawings.

b. Structures at or on grade: Within 0.02 feet (including hardscape).

PART 2 - PRODUCTS

2.01 MATERIALS

A. On-site and borrow fill:

1. Non-expansive, predominantly granular material:

a. Particles less than 2 inch in any dimension;
b. Free of organic and inorganic debris;
c. Not more than 12 percent by weight passing the No. 200 sieve.

2. Acceptable to geotechnical engineer retained by Owner.
3. Top soil: All soil above the lower root line of fine vegetation (grasses and sod).
4. Borrow site: At location approved by Owner.

B. Recycled fill: Refer to Division 02 Section "Selective Site Demolition". Limit use as follows:

1. Not more than 10 percent (by volume, compacted) of total fill.
2. Not less than 2 feet below bottom of concrete foundations.
3. Imported, recycled fill is not acceptable.

PART 3 - EXECUTION

3.01 PROTECTION

A. Public and adjacent properties: Protect in accord with applicable laws and ordinances.

B. Existing on-site features, plant life, including trees, scheduled to remain:

1. Protect from damage at all times.
2. Do not allow earth-moving equipment within the branch spread perimeter (drip line) of existing trees.

C. Utilities:

1. When utility line excavation occurs near existing utilities, whether or not indicated on Drawings, maintain existing utility services fully operational. Protect and support utility lines in a manner to prevent damage. Method of protection is subject to Owner's approval.
2. Expeditiously repair damaged utilities at no cost to Owner.
3. Remove abandoned lines encountered during excavating and dispose of off-site. Report unidentified lines to Owner prior to removal.
4. Capping and rerouting of indicated active utility lines encountered during Work of this Section will be performed as part of the work of section pertaining to utility encountered.

D. Dust control:

1. Throughout entire construction period, effectively dust-palliate working area, unpaved roads, and involved portions of site.
2. Palliation: Intermittently water and sprinkle with such frequency as will satisfactorily allay dust at all times. Chemical treatment of any type is not permitted. Use of reclaimed water shall conform to requirements and guidelines of governing health authorities and be specifically approved by Owner.

3.02 STRIPPING AND CLEARING

A. Strip dry ground areas of all top soil, surface vegetation, muck, roots, organic material, and debris to result in a uniform surface of exposed clean, natural sand or soils.

B. Except as directed otherwise by Owner, dispose of all waste materials to legal off-site disposal areas.

C. Soil redistribution: Do not redistribute existing soils beyond immediate area of origin

3.03 EXCAVATIONS

A. Excavate materials of every nature to dimensions and elevations indicated. Use equipment of suitable type for materials and conditions involved.

B. Where additional excavation is required to remove unsatisfactory materials encountered, such additional work shall be paid for by means consistent with terms of the Contract.

C. Remove from site materials not approved for use as topsoil or fill and excess excavated materials.

3.04 FILLING, COMPACTING, AND GRADING

A. Filling:

1. Place fill in uniform lifts not exceeding 8 inches in loose thickness that will uniformly compact to the required densities.
2. Bring each layer to between ±2 percent of optimum moisture content before compaction. Add water by uniform sprinkling and mixing with soils. Add or blend additional fill materials or dry out existing materials as required.
3. When moisture content and condition of each layer is satisfactory, compact to specified density. Compact areas not accessible to motor-driven equipment with mechanical or heavy hand tampers.
4. Rework compacted areas failing to meet specified density as determined by tests. Recompact and retest as required or directed to achieve proper density.
5. Correct unauthorized excavation made below depth indicated, as acceptable to geotechnical engineer retained by Owner, at no additional cost to Owner.
6. Do not place fill materials until subgrade is acceptable to geotechnical engineer retained by Owner, nor until preceding fill layer is acceptable.
7. Prior to placing fill material on existing surfaces, scarify to a depth of 6 inches and recompact to same degree of compaction as overlying fill material.

B. Compacting:

1. Parking and pavement areas: Compact soils below all parking areas, walks, slabs, and asphalt pavement to 90 percent of the Modified Proctor maximum dry density for full depth of fill.

2. Landscape areas: Compact soils below all landscape, planting ,and sod areas to 85 percent of the Modified Proctor maximum dry density for the full depth of fill. Building areas: Compact soils below all buildings and for a distance of 5 feet beyond perimeter footing to at least 90 percent of the Modified Proctor maximum dry density for the full depth of fill. Proof roll within these limits with a self-propelled vibratory compactor capable of imparting a maximum dynamic drum force of at least 36,000 lb. Proof roll from a level that is 2 feet above ambient water table. This may require locally filling low areas prior to utilizing a vibratory compactor. Densify subsoils by making repeated overlapping coverages of roller as it operates at its full vibrational frequency, and at a travel speed of not more than 2 feet. per second.

3. Minor structures: Support catch basins and other minor structures on bottom and all sides by soils compacted to 90 percent of the Modified Proctor maximum dry density for full depth of fill.

C. Grading:

1. Grade (cut or fill) site to the elevations indicated on Drawings within the following tolerances:

a. All cuts and fills: Within a tolerance ±0.10 feet for grades indicated on Drawings.

b. Structures at or on grade: Within 0.02 feet (including hardscape).

2. Elevations and contours indicated on Drawings are to finish grade unless otherwise indicated. Make allowances for pavement thickness, bases, and sod material where applicable.

3.05 DEWATERING

A. Drain excavations and other prepared work areas occurring below groundwater level and maintain in a dewatered condition while performing work at those elevations.

B. Prevent surface water drainage from entering excavations, and ponding on subgrades and other prepared work areas.

C. Maintain dry excavations and subgrades by whatever means necessary while working in each area.

1. Reduce groundwater level to a sufficient depth to ensure that bottom soils are not saturated or develop a "quick" condition.

2. Reroute surface water drainage away from excavations, prepared subgrades, and other work areas.

3. Prevent excessive rainwater, to the extent that detrimental softening, undermining, washout, and similar damage would occur, from accumulating in excavations, upon subgrades, and at other prepared work areas.

4. Do not use excavations as temporary drainage.

D. Dewatering methods selected by Contractor shall be subject to approval by Owner.

-END OF SECTION-

SECTION 31 2302
EXCAVATION AND FILL FOR UTILITIES

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 SECTION INCLUDES

A. Dewatering, excavating, shoring, sheeting, bracing, trenching, backfilling, and all other earthwork operations required for utility and other underground lines and appurtenances.

B. Providing access to open trenches after utility lines have been installed and bedded, but prior to backfilling being commenced, to permit recording of record or "as-built" survey information.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Geotechnical Report.

B. Division 31 Section “Site Demolition”.

C. Division 31 Section "Excavation and Fill for Structures".

D. Division 33 Section "Underground Utilities Marking".

E. Division 33 Section “Site Water Distribution System”.

F. Division 33 Section “Sanitary Sewer System”.

G. Division 33 Section “Storm Drainage System”.

1.04 QUALITY ASSURANCE

A. Tests and inspections:

1. Procedure: In accordance with Division 01 Sections.
2. Test methods:
    a. Maximum dry density of backfill materials shall be determined by ASTM D 1557, Procedure A.
    b. Field density tests shall be determined by ASTM D 1556, ASTM D 2922, or ASTM D 2937.
3. Required tests:
    a. Backfill material: Determine suitability of backfill and bedding material not previously evaluated.
    b. Maximum density tests: Determine optimum moisture content and maximum dry density of backfill and bedding materials placed and

compacted.

c. Field density tests: Determine in-place density of backfill materials placed and compacted. Conduct one test for every 100 linear feet of trench and one test for each 1 foot vertical lift.

d. Other tests as may be required by Owner.

4. Required inspections:

a. Excavation inspection: Detailed inspection of exposed excavations prior to placing bedding and backfill material.

b. Bedding conditions: Determine and evaluate condition of bedding to receive utility lines.

B. Requirements of regulatory agencies: In addition to complying with other legal requirements, comply with the following.

1. Code of Federal Regulations Title 29 CFR Part 1926, Subpart P, Excavations.
2. Occupational Safety and Health Administration Document 2226.

C. Reference specifications and standards:

1. ASTM: D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM: D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lbf/ft3).
3. ASTM: D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
4. ASTM: D 2937 Density of Soil In-Place by the Drive-Cylinder Method.
5. CFR: Title 29 CFR Part 1926 Safety and Health Regulations for Construction.
6. OSHA: Document 2226 Excavations.

1.05 SUBMITTALS

A. Procedures: In accordance with Division 01 Sections.

B. Drawings and engineering design calculations: Signed and sealed engineering drawings and calculations for required shoring, sheeting, or cribbing for approval prior to starting installation of shoring, sheeting, or cribbing.

PART 2 - PRODUCTS

2.01 MATERIALS

A. On-site materials: Materials obtained by selective stockpiling of excavated soils.

1. Bedding: Unless indicated otherwise on Drawings, conform to the following.

a. Clean sand and native free-draining granular materials, free from all vegetation and debris or as indicated on Drawings.

b. Bedding shall meet gradation requirements when tested in accord with ASTM D 422 and have a minimum sand equivalent of 30 as determined by ASTM D 2419.

Sieve Size	% Passing Sieve by Weight
1/2 in.	100
No. 4	70 - 100
No. 16	50 - 90
No. 50	10 - 50
No. 200	0 - 10

2. Backfill: Clean material, free from all vegetation and debris. Do not use rocks or lumps larger than 2 inches in any dimension.

B. Borrow fill:

1. Non-expansive, predominantly granular material:

   a. Particles less than 2 inches in any dimension;
   b. Free of organic and inorganic debris;
   c. Not more than 12 percent by weight passing the No. 200 sieve behind retaining walls and 25 percent elsewhere.

2. Acceptable to geotechnical engineer retained by Owner.

PART 3 - EXECUTION

3.01 PROTECTION

A. Public and adjacent properties: Protect in accord with applicable laws and ordinances.

B. Existing on-site features, plant life, including trees, scheduled to remain:

1. Protect from damage at all times.
2. Do not allow earth-moving equipment within the branch spread perimeter (drip line) of existing trees.
3. Do not cut tree roots over 2 inches in diameter without prior approval from Owner.
4. Support trees during excavation in an approved manner.
5. When excavation adjacent to existing trees is necessary, use all possible care to avoid injury to trees and tree roots. Excavate by hand all areas where 2 inch and larger roots occur. Tunnel under and heavily wrap with burlap roots 2 inches and larger in diameter, except directly in the path of pipe or conduit, to prevent scarring or excessive drying. When a trenching machine runs close to trees having roots smaller than 2 inches in diameter, hand trim wall of trench adjacent to tree, making clean cuts through roots. Paint roots 1 inch and larger in diameter with two coats of Tree Seal, or Owner-approved equivalent. Close trenches adjacent to trees within 24 hr.; when this is not possible, shade side of trench adjacent to tree with burlap or canvas.
6. All work around and adjacent to existing trees, including inspection prior to backfill, shall be approved by Owner. Obtain Owner's approval in writing for all procedures prior to commencement of work. Trees that die due to damage or unacceptable work shall be back-charged to Contractor.

C. Where utility line excavation occurs in lawn, grassed, or landscaped areas, carefully

remove and stockpile sod and plants to preserve for transplanting.

1. Place excavated material from trenches on lawn or grass, provided a drop cloth or other approved method is employed to protect lawn or grass from permanent damage. Do not keep stockpiled materials on lawn or grass for more than 72 hr.
2. Immediately after completion of backfilling and testing of utility lines, replace sod and replant plants in a manner to restore lawn, grass, and landscaping to its original condition within practical limits. Replace damaged landscaping at no cost to Owner as part of the work of this Section.

D. Where utility line excavation occurs in paved areas, saw-cut existing pavement along straight, uniform lines such that the amount of pavement cut and removed shall be the minimum consistent with safe excavation practices.

1. Do not use removed pavement as backfill material.
2. Replace removed pavement with new pavement to match existing in accord with Project Specifications.

E. Open trenches: Barricade all open trenches during work hours and cover at the close of each day's work.

F. Utilities:

1. When utility line excavation occurs near existing utilities, whether or not indicated on Drawings, maintain existing utility services fully operational. Protect and support utility lines in a manner to prevent damage. Method of protection is subject to Owner's approval.
2. Expeditiously repair damaged utilities at no cost to Owner.
3. Remove abandoned lines encountered during excavating and dispose of off-site. Report unidentified lines to Owner prior to removal.
4. Capping and rerouting of indicated active utility lines encountered during Work of this Section will be performed as part of the work of section pertaining to utility encountered.

G. Dust control:

1. Throughout entire construction period, effectively dust-palliate working area, unpaved roads, and involved portions of site.
2. Palliation: Intermittently water and sprinkle with such frequency as will satisfactorily allay dust at all times. Chemical treatment of any type is not permitted.
3. Use of reclaimed water shall conform to requirements and guidelines of governing health authorities and be specifically approved by Owner.

H. Water control:

1. Maintain trenches and other excavations free of water while lines are being placed and until backfill has been completed and approved.
2. Maintain adequate pumping equipment at all times to provide for emergencies.
3. Dispose of water in such a manner as not to create a nuisance, cause damage to property, or interfere with activities of other contractors. Prevent water from

migrating outside of construction areas. Use Owner-approved methods and materials to confine water to construction areas. Failure to contain water is not permitted.

4. Dewater as required to maintain site in a relatively dry condition, including well point dewatering.
5. Methods of dewatering and disposal of water are subject to Owner's approval.

I. Bracing and shoring:

1. Support excavations in accord with all legal requirements.
2. Set and maintain sheet piling and shoring timbers in a manner that will prevent caving of walls of excavations or trenches and not impose other loads or surcharges on lines.
3. When it is impractical to remove shoring and bracing, obtain approval from Owner to leave in place. Record locations of such "in-place" shoring and bracing on Project Record Documents.

J. Stockpiled excavated materials: Confine excavated materials to immediate area of stockpiled location.

K. Soil redistribution: Do not redistribute any existing soils beyond the immediate area of origin.

3.02 EXCAVATION

A. General: Include removal of materials and obstructions that interfere with the execution of the Work.

1. Unless indicated otherwise, excavation for utilities lines shall be by open trench.
2. Sides of trenches shall be as nearly vertical as practicable.
3. Obtain prior approval from Owner for use of tunneling.

B. Trench widths:

1. Lines less than 6 inches outside diameter: 18 inches minimum.
2. Larger lines: Clear distance on each side of line of not less than 8 inches or more than 1/2 of outside diameter of line.

C. Trench depth: Excavate trenches to lines and grades as necessary for construction of utility lines indicated.

D. Over-excavation: Backfill over-depth excavations to required grade with specified bedding and backfill material. Compact bedding and backfill material to specified density.

E. Perform any dewatering and pumping required to keep excavations free of standing water.

F. Refer to geotechnical reports for seasonal high groundwater table elevation estimates. It is the sole responsibility of contractor to make its own judgments as to the actual conditions, and to draw its own conclusions as to means and methods required for performance of the work. Provide dewatering, if required, at whatever elevation groundwater is actually encountered.

G. A plan for any proposed dewatering shall be submitted for approval prior to

commencement of any such work. Any permitting for dewatering which may be required shall be the responsibility of Contractor.

H. Sequence, schedule, coordinate, and perform the work so as to maintain safe, unobstructed passage as required for emergency egress and general site access. Provide any and all bridging of trenches of work, barricades, etc., that may be required to comply with this requirement.

3.03 BACKFILL

A. General: Backfill consists of bedding, backfill, and restoration of surface.

B. Bedding: Bedding is defined as material supporting, surrounding, and extending to 12 inches above the top of utility line. Bedding shall not be required under or around structures, except at utility lines.

1. Do not cover lines until they have been inspected and approved for alignment and grade and recording of record or "as-built" survey information has been performed.
2. Commence bedding immediately after approval and survey information recording, to preclude damage to utility lines.
3. Carefully place bedding around utility lines so as not to displace or damage line, and fill symmetrically on each side of line to 12 inches above top of line.
4. Compact bedding to 90 percent of the maximum dry density in accord with ASTM D 1557 using mechanical equipment.

C. Backfill: Backfill includes material from 12 inches above the lines to, and including, surface restoration.

1. Do not backfill against structures until concrete has attained sufficient strength to withstand loads, and structures have been approved.
2. Place backfill in loose uniform lifts not exceeding 8 inches.
3. Use mechanical compactors for compaction of backfill.

D. Coordinate and ensure installation of underground utilities marking in accord with Division 33 Section "Underground Utilities Marking".

E. Compacting:

1. Parking and pavement areas: Compact soils below parking areas, walks, slabs, and asphalt concrete pavement to 90 percent of the maximum dry density in accord with ASTM D 1557 for full depth of fill.
2. Landscape areas: Compact soils below landscape, planting, or sod areas to 85 percent of the maximum dry density in accord with ASTM D 1557 for full depth of fill.
3. Building areas: Compact soils below all buildings and for a distance of 5 feet beyond perimeter footing to at least 90 percent of the maximum dry density in accord with ASTM D 1557 for full depth of fill.
4. Minor structures: Support catch basins and other minor structures on bottom and all sides by soils compacted to 90 percent of the maximum dry density in accord with ASTM D 1557 for full depth of fill.

3.04 ADJUST AND CLEAN

A. Surface restoration:

1. Restore surface areas over trenches equivalent to conditions which existed prior to start of work.

B. Reconstruct surfaces in accord with applicable Sections of the Specifications.

3.05 Disposal:

1. Debris:

a. Remove and dispose of all rubbish, debris, and vegetation as it accumulates.
b. Dispose of debris off-site or at an on-site disposal area designated by Owner.

2. Excess soil: Stockpile at an on-site area designated by Owner.

-END OF SECTION-

SECTION 31 23 04
EXCAVATION AND FILL FOR STRUCTURES

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 SECTION INCLUDES

A. Excavating, backfilling, and compacting for structures.

B. Restore grades to required elevations.

C. Remove excess materials from site.

D. Pumping and dewatering.

E. Support of excavations.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Geotechnical Report.

B. Division 03 Section "Cast-In-Place Concrete".

C. Division 31 Section “Site Demolition”.

D. Division 31 Section "Excavation and Fill for Utilities".

1.04 QUALITY ASSURANCE

A. Tests and inspections:

1. Procedure: In accordance with Division 01 Sections.

2. Test methods:

a. Maximum dry density of backfill materials shall be determined by ASTM D 1557, Procedure A.
b. Field density tests shall be determined by ASTM D 1556, ASTM D 2922, or ASTM D 2937.

3. Required tests:

a. Backfill material: Determine suitability of backfill material not previously evaluated.
b. Maximum density tests: Determine optimum moisture content and maximum dry density of backfill materials placed and compacted.
c. Field density tests: Determine in-place density of backfill materials placed and compacted. one test for every 100 cu. yd. of material placed and one test for each 1 foot vertical lift.
d. Other tests as may be required by Owner.

4. Required inspections:
    a. Excavation inspection: Detailed inspection of exposed excavations prior to placing backfill material.
    b. Placement and compaction inspection: Continuous inspection and monitoring.

B. Requirements of regulatory agencies: In addition to complying with other legal requirements, comply with the following.

1. Code of Federal Regulations Title 29 CFR Part 1926, Subpart P, Excavations.
2. Occupational Safety and Health Administration Document 2226.

C. Reference specifications and standards:

1. ASTM: D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM: D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lbf/ft3).
3. ASTM: D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
4. ASTM: D 2937 Density of Soil In-Place by the Drive-Cylinder Method.
5. CFR: Title 29 CFR Part 1926 Safety and Health Regulations for Construction.
6. OSHA: Document 2226 Excavations.

1.05 SUBMITTALS

A. Procedures: In accordance with Division 01 Sections.

B. Drawings and engineering design calculations: Signed and sealed engineering drawings and calculations for required shoring, sheeting, or cribbing for approval prior to start of installation of shoring, sheeting, or cribbing.

PART 2 - PRODUCTS

2.01 MATERIALS

A. On-site materials and borrow fill:

1. Non-expansive, predominantly granular material:
    a. Particles less than 2 inches in any dimension.
    b. Free of organic and other deleterious materials.
    c. Not more than 12 percent by weight passing the No. 200 sieve behind retaining walls and 25 percent elsewhere.
2. Acceptable to a geotechnical engineer retained by Owner.
3. Top soil: All soil above the lower root line of fine vegetation (grasses and sod).
4. Borrow site: At location approved by Owner.

PART 3 - EXECUTION

3.01 PROTECTION

A. Public and adjacent properties: Protect in accord with applicable laws and ordinances.

1. Existing on-site features, plant life, including trees, scheduled to remain: Protect from damage at all times.
2. Do not allow earth-moving equipment within the branch spread perimeter (drip line) of existing trees.
3. Do not cut tree roots over 2 inches in diameter without prior approval from Owner.
4. Support trees during excavation in an approved manner.
5. When excavating adjacent to existing trees is necessary, use all possible care to avoid injury to trees and tree roots. Excavate by hand areas where 2 inch and larger roots occur. Tunnel under and heavily wrap with burlap roots 2 inches and larger in diameter, except directly in the path of pipe or conduit, to prevent scarring or excessive drying. When a trenching machine runs close to trees having roots smaller than 2 inches in diameter, hand trim wall of trench adjacent to tree, making clean cuts through roots. Paint roots 1 inch and larger in diameter with two coats of Tree Seal, or Owner-approved equivalent. Close trenches adjacent to trees within 24 hr.; when this is not possible, shade side of trench adjacent to tree with burlap or canvas.
6. All work around and adjacent to existing trees, including inspection prior to backfill, shall be approved by Owner. Obtain Owner's approval in writing for all procedures prior to commencement of work. Trees that die due to damage or unacceptable work shall be back-charged to Contractor.

B. Utilities:

1. When utility line excavation occurs near existing utilities, whether or not indicated on Drawings, maintain existing utility services fully operational. Protect and support utility lines in a manner to prevent damage. Method of protection is subject to Owner's approval.
2. Expeditiously repair damaged utilities at no cost to Owner.
3. Remove abandoned lines encountered during excavating and dispose of off-site. Report unidentified lines to Owner prior to removal.
4. Capping and rerouting of indicated active utility lines encountered during Work of this Section will be performed as part of the work of section pertaining to utility encountered.

C. Dust control:

1. Throughout entire construction period, effectively dust-palliate working area, unpaved road, and involved portions of site.
2. Palliation: Intermittently water and sprinkle with such frequency as will satisfactorily allay dust at all times. Chemical treatment of any type is not permitted.
3. Use of reclaimed water shall conform to requirements and guidelines of governing health authorities and be specifically approved by Owner.

D. Water control:

1. Maintain excavation free of water while foundations are being placed and until backfill has been completed and approved.
2. Maintain adequate pumping equipment at all times to provide for emergencies.
3. Dispose of water in such a manner as not to create a nuisance, cause damage to property, or interfere with activities of other contractors. Prevent water from migrating outside of construction areas. Use Owner-approved methods and

materials to confine water to construction areas. Failure to contain water is not permitted.

4. Dewater as required to maintain site in a relatively dry condition, including well point dewatering.
5. Methods of dewatering and disposal of water is subject to Owner's approval.

E. Cribbing and shoring:

1. Provide temporary or permanent cribbing, sheeting, and shoring as necessary to safely retain earth banks and protect excavations from caving or other damage.
2. Design, install, and maintain cribbing, sheeting, and shoring and remove after use.

F. Stockpiled excavated materials: Confine excavated materials to immediate area of stockpiled location.

G. Soil redistribution: Do not redistribute existing soils beyond immediate area of origin.

3.02 STRIPPING

A. Stockpile materials from excavations suitable for use in fill and backfill.

B. Remove from site materials not approved for use as topsoil, fill or backfill, and excess excavated materials.

3.03 EXCAVATING

A. Excavate materials of every nature to dimensions and elevations indicated on Drawings. Use equipment of suitable type for materials and conditions involved.

B. Extend excavation a sufficient distance from walls to allow for forming and shoring, application of waterproofing, installation of services, and approvals. Do not excavate below indicated depths.

C. Foundations: Excavations may be made to net sizes plus 2 inches for casting concrete directly against earth banks, provided, in opinion of City INSPECTOR of record or geotechnical engineer, earth banks are sufficiently stable to remain in position until concrete has been placed.

1. If, in opinion of Architect or City Engineer, earth banks are not stable enough for concrete placement, excavate additional width necessary to provide space for formwork, and backfill after forms have been removed.
2. All trenches shall be formed.

D. Correct unauthorized excavation made below depths indicated on Drawings, as recommended by geotechnical engineer retained by Owner, at no additional cost to Owner.

E. Where additional excavation is required to remove unsatisfactory materials encountered, such additional work shall be paid for by means consistent with terms of Contract.

3.04 FILL, BACKFILL, AND COMPACTION

A. Fill and backfill:

1. Place earth fill and backfill in layers that will uniformly compact to required

densities, but in loose layers not more than 8 inches thick.

a. Place backfill only after walls have been supported by completion of interior floor systems or have been sufficiently braced to resist imposed loading.
b. Place backfill against walls below grade after waterproofing systems have been completed and approved.
c. Protect waterproofing systems during backfill operations. If waterproofing is damaged, do not continue backfilling until membrane damage is repaired as approved by Owner.
d. Restore grades to indicated elevations.

2. Slurry cement (lean concrete) backfill:

a. Where specifically indicated on Drawings, slurry cement backfill consisting of a fluid, workable mixture of aggregate, cement, and water shall be used as foundation structure backfill.
b. Cement shall be Portland cement conforming to provisions in Division 03 Section "Cast-In-Place Concrete", except that testing will not be required.
c. Water used for slurry cement backfill shall be free from oil, salts, and other impurities which would have an adverse effect on quality of backfill material.
d. At Contractor's option, aggregate shall be either 1) material selected from excavation, imported material, or a combination thereof, which is free of organic material and other deleterious substances, or 2) commercial quality concrete sand. Material selected from excavation, imported material, or a combination thereof shall meet the following grading:

Sieve Sizes	Percentage Passing
1-1/2 in.	100
1 in.	80-100
3/4 in.	60-100
3/8 in.	50-100
No. 4	40-80
No. 100	10-40

e. Aggregate, cement, and water shall be proportioned either by weight or by volume. Not less than 188 lb. of cement shall be used for each cu. yd. of material produced. Water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate while being placed.
f. Materials for slurry cement backfill shall be thoroughly machine-mixed in a pugmill, rotary drum, or other approved mixer. Mixing shall continue until cement and water are thoroughly dispersed throughout material. Slurry cement backfill shall be placed in the Work within 1 hr. after mixing.
g. Slurry cement backfill shall be placed in a uniform manner that will prevent voids in, or segregation of, backfill and will not float or shift foundation structures. Foreign materials which fall into trench prior to or

during placing of slurry cement backfill shall be immediately removed.

h. Placing material over slurry cement backfill shall not commence less than 4 hours after slurry cement backfill has been placed.

B. Compaction:

1. Bring each layer to with ±2 percent of optimum moisture content before compaction. Add water by uniform sprinkling. Jetting and flooding are prohibited. Add and blend additional fill materials or dry out existing materials as required.
2. When moisture content and condition of each layer is satisfactory, compact to not less than 90 percent of maximum dry density in accord with ASTM D 1557.
3. Compact areas not accessible to motor-driven equipment with mechanical or heavy hand tampers.
4. Rework compacted areas failing to meet specified maximum dry density, as determined by tests. Recompact and retest as required to achieve 90 percent of the maximum dry density in accord with ASTM D 1557.

C. Grading:

1. Build compacted backfills to indicated or required finish grades, less allowances for thickness of slabs, paving, and required base courses.
2. Rough grade backfilled surfaces smooth, level to within 0.10 foot of intended surface. Compact loose material and maintain in a moist condition until covered.

-END OF SECTION-

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

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 SECTION INCLUDES

A. Erosion, sedimentation and water pollution control features in place or relocated as indicated on Drawings, prior to start of all grading or construction.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Temporary facilities and controls.

B. Division 31 Section "Grading".

1.04 DEFINITIONS

A. Control features: Includes, but not limited to berms, erosion control blankets, gravel bags, sand bags, silt barriers, silt fences, swales, and other features in accord with referenced specifications and standards.

1.05 QUALITY ASSURANCE

A. Performance criteria: Prevention, control and abatement of erosion, sedimentation and water pollution shall be in accord with:

1. As indicated on Drawings.
2. As called for in City's approved Storm Water Pollution Prevention Plan (SWPPP).
3. As established under the accepted Contractor's Stormwater Management Plan (CSMP):
    a. Contractor shall prepare a comprehensive plan for the management of incident and transient storm water within the limits of work or such larger area as may be indicated on the plans.
    b. Contractor's plan shall indicate all measures required to comply with the applicable requirements of the SWPPP as relates to the Work and the situation within limits of work during the Contract Time.
    c. The SWPPP was prepared solely for the purpose of expediting permitting for the Work, and Owner's having prepared same shall not be construed as relieving Contractor of any responsibility it has to establish and maintain proper stormwater management pursuant to its signing of the SWPPP Certificates of Compliance and any other applicable regulations. Neither shall City's review or approval of the CSMP relieve the Contractor of such responsibility.

4. Reference specifications and standards: City's approved Storm Water Pollution Prevention Plan (SWPPP). The SWPPP shall conform to the requirements in these

   Special Provisions, and the California Stormwater Best Management Practice Handbook for Construction.

1.06 SUBMITTALS

A. Procedures: In accordance with Division 01 Sections.

B. Shop drawings: Plans and details, including layout and locations of erosion and sedimentation control features. Indicate dimensions, materials, and anchorage underlying substrates.

C. Product data:

1. Manufacturer's detailed technical materials and application data.
2. Submit filter fabric material specifications and installation configuration prior to start of construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials for control features: In accord with referenced specifications, standards, and approved submittals.

PART 3 - EXECUTION

3.01 ERECTION

A. General: Erect and maintain control features in accord with Drawings and referenced specifications, standards, and approved submittals.

B. Maintenance:

1. Inspect control features immediately after each rainfall and similar event, and at least once a day during periods of prolonged rainfall and similar events. Immediately repair control features to maintain intended function and performance.
2. Replace sandbags and other materials that exhibit damage, decomposition, or are otherwise ineffective.
3. Prevent excessive accumulation of sediment deposits. Remove sediment deposits at a frequency of not less than after each rainfall and similar event.

3.02 REMOVAL OF CONTROL FEATURES

A. Remove control features when directed by Owner.

-END OF SECTION -

SECTION 32 1216
ASPHALT CONCRETE PAVING

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 SECTION INCLUDES

A. Asphalt concrete paving.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Division 31 Section “Site Demolition”.

B. Division 31 Section "Grading".

C. Division 31 Section "Excavation and Fill for Utilities".

D. Division 31 Section “Excavation and Fill for Structures”.

E. Division 32 Section “Site Concrete Work”.

F. Division 32 Section "Pavement Markings and Bumpers".

G. Division 33 Section “Site Water Distribution System”.

H. Division 33 Section “Sanitary Sewer System”.

I. Division 33 Section “Storm Drainage System”.

1.04 QUALITY ASSURANCE

A. Tests and inspections:

1. Procedure: In accordance with Division 01 Sections.
2. Required tests:
    a. Compaction:
        1) Crushed aggregate and crushed miscellaneous base: Perform field density tests in accord with SSPWC Section 211-2
        2) Asphalt concrete surface course: Perform field density tests in accord with SSPWC Section 302-5.6.2.
    b. Water flood tests of finished paving: In addition to tests and requirements of SSPWC Section 302-5.6.2, conduct a water flood test of areas as directed by Owner.
3. Required inspections:
    a. Base:
        1) Verify that base meets or exceeds specified base course.

2) Visually observe uniformity and moisture condition of base material as it is delivered to project site.

3) Observe and monitor placement and construction of base material to ensure that work meets or exceeds specified requirements.

4) Make random depth checks before and after final compaction to assure minimum compacted thickness is obtained.

B. Reference specifications and standards:

1. ASTM: C 136 Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM: C 150 Portland Cement.
3. ASTM: D 558 Moisture-Density Relations of Soil-Cement Mixtures.
4. ASTM: D 977 Emulsified Asphalt.
5. ASTM: D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lbf/ft3).
6. ASTM: D 2026 Cutback Asphalt (Slow-Curing Type).
7. ASTM: D 2028 Cutback Asphalt (Rapid-Curing Type).
8. ASTM: D 3320 Emulsified Coal-Tar Pitch (Mineral Colloid Type).
9. SSPWC: Standard Specifications for Public Works Construction.

1.05 SUBMITTALS

A. Procedures: In accordance with Division 01 Sections.

B. Product data: Manufacturer's detailed technical materials and application data, including technical bulletins, guides, and manuals for seal coat materials.

C. Certificates/certifications: Supplier's certification that materials conform to Specifications requirements.

1. Class and grade of asphalt concrete mixtures in accord with SSPWC Section 203.
2. Sieve analysis of asphalt concrete aggregates in accord with SSPWC Section 211-1.

1.06 PROJECT CONDITIONS

A. Existing conditions: Do not conceal or cover any work until required tests or inspections have been performed and accepted.

B. Environmental requirements: Unless recommended otherwise by material or product manufacturer conform to the following.

1. Apply or install products or systems only when ambient temperatures are above 50°F and rising.
2. Place base course when ambient temperature is above 40°F.

C. Protection: Protect completed installation from damage of subsequent construction activities. Immediately remove all foreign matter that accumulates on exposed surfaces in accord with fabricator or manufacturer's recommendations.

1. Maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.
2. Provide flagmen, barricades, warning signs, and warning lights for movement of traffic and safety, and to cause the least interruption of work.

D. Sequencing and scheduling:

1. Coordinate and sequence the application or installation of work of this Section with adjacent or integral materials, products, and work specified in other Sections. Such work includes, but is not limited to, the following:

   a. Concrete curbs and gutters.
   b. Concrete paving.
   c. Utility services.
   d. Demolition of existing asphalt concrete.
   e. Cold mill existing asphalt concrete paving.

2. Order specified materials, products, and similar items with extended "long lead" (ordering) times, sufficiently in advance of scheduled application, or installation dates to not delay the scheduled progress of the Work. Such items include but are not limited to the following:

   a. Items of rare ("short") supply.
   b. Items not of standard stock.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crushed aggregate base: Conform to SSPWC Section 200 2.2.

B. Crushed miscellaneous base: Conform to SSPWC Section 200-2.4. Refer to Division 02 Section "Selective Site Demolition". Limit use as follows:

1. Confine to extent (areas and locations) where indicated on Drawings or as directed by Owner.
2. Imported material is not acceptable.

C. Asphalt concrete: Conform to SSPWC Section 203-6, B PG70-10 for base course, if required on the drawings, C2 PG70-10 for surface course, D2- or E PG70-10 for overlay filling and patching, unless indicated otherwise on Drawings.

D. Prime coat: Cutback asphalt, slow-curing, Grade SC 250, in accord with SSPWC Section 203 2 (ASTM D2026).

E. Tack coat: Anionic asphalt emulsion, slow-setting, Grade SS 1H, SSPWC Section 203 3.

F. Seal/slurry coat: If indicated on the plans.

1. New paving: Emulsified asphalt, Grade SS 1h, conforming to SSPWC Section 203-3 (ASTM D 977) blend of emulsified asphalt and coal-tar emulsion (not less than 10 percent).
2. Existing paving: Plant-blended asphalt emulsion and mineral aggregate mixture, conforming to SSPWC Section 203-9.

2.02 MIXES

A. Asphalt concrete: Plant mix in accord with SSPWC Section 203-6

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces for conditions that will adversely affect execution, permanence, and quality of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Proof-roll subgrade using heavy, rubber-tired rollers to locate unstable areas or areas requiring additional compaction.

B. Compact unstable areas or areas requiring additional compaction in accord with SSPWC Section 301-1.

C. Cold mill areas as shown on Drawings in accord with SSPWC Section 302-5.2.

3.03 APPLICATION/INSTALLATION/PERFORMANCE

A. Crushed aggregate and crushed miscellaneous base: Transport, spread, shape, compact, and finish crushed aggregate and crushed miscellaneous base material in accord with SSPWC Section 301-2, to minimum compacted thickness as indicated on Drawings. Compact in excess of 95 percent of Modified Proctor maximum dry density in accord with ASTM D 1557.

B. Asphalt concrete:

1. Prime coat: After base course has been placed to required grades and approved, apply prime coat in accord with SSPWC Section 302-5.3.
2. Tack coat: When new asphalt is to be placed against existing or new concrete or asphalt surfaces, such as curbs, gutters, walls, structures, or other paving, apply tack coat in accord with SSPWC Section 302-5.4.
3. Asphalt concrete: Provide transportation, placing, and compacting of asphalt concrete, preparation of application surfaces, joints, tolerances, and protection of finished asphalt in accord with SSPWC Section 302-5.

C. Seal/slurry coat: After asphalt concrete paving has sufficiently cured, apply seal/slurry coat in accord with SSPWC Section 302-8, unless otherwise recommended by manufacturer.

3.04 FIELD QUALITY CONTROL

A. Mixes: Do not deliver batches of base or asphalt concrete materials to job site which do not conform to specified requirements.

B. Flood test: All finished asphalt concrete paving surfaces that retains standing water when flood tested shall be deemed defective.

C. Physical defects: Any portion of asphalt concrete paving that exhibits creeping, shoving, cracking, raveling, softening, or other similar defects during warranty period shall be deemed defective.

D. Removal and replacement of defective asphalt concrete paving:

1. Remove and replace defective areas, including base and subgrade, as directed by Owner. Cut away, remove, and fill patch area with fresh, hot asphalt concrete.
    a. As a minimum, remove defective areas for full depth of asphalt concrete surfacing course.
    b. Cut sides perpendicular and parallel to direction of traffic with edges vertical.
    c. Apply tack coat to exposed asphalt concrete surfaces before placing new asphalt concrete mixture.
    d. Compact by rolling to specified surface density and smoothness.

3.05 ADJUST AND CLEAN

A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials.

B. Protection: After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened.

END OF SECTION

SECTION 321313
SITE CONCRETE WORK

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 SECTION INCLUDES

A. Site concrete work, including subgrade preparation, formwork, reinforcing steel, concrete, and accessory materials for:

1. Pavement, curbs, and gutters.
2. Retaining walls, catch basins, manholes, valve and sump pits, and similar structures.
3. Footings for fence posts, and similar work of other trades.
4. Dumpster and compactor equipment pads.
5. Thrust blocks for pressure piping systems.
6. Mechanical and electrical equipment pads.
7. Ductbanks.
8. Other site concrete work as indicated on Drawings.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Geotechnical Report.

B. Division 31 Section “Site Demolition”.

C. Division 31 Section "Grading".

D. Division 32 Section "Concrete Paving Joint Sealants".

E. Division 33 Section "Sanitary Sewerage System".

F. Division 33 Section "Storm Drainage System".

G. Precast concrete and other use concrete specified as part of Division 22 Plumbing and Division 26 Electrical and Lighting.

1.04 DEFINITIONS

A. Slip resistance: Slip index of not less than 0.5 when tested dry and wet (with an unbroken film of pure water) in accord with ASTM F 1677 or ASTM F 1679, using a Neolite test pad.

1.05 QUALITY ASSURANCE

A. Geotechnical data: Refer to Geotechnical Report.

B. Tests and inspections:

1. Testing laboratory services: Refer to Division 01 Sections. Soil bearing and compaction:

a. Test methods:

1) Maximum dry density of backfill materials shall be determined by ASTM D 1557, Procedure A.

2) Field density tests shall be determined by ASTM D 1556, ASTM D 2922, or ASTM D 2937.

b. Required tests:

1) Backfill material: Determine suitability of backfill material not previously evaluated.

2) Maximum density tests: Determine optimum moisture content and maximum dry density of backfill materials placed and compacted.

3) Field density tests: Determine in-place density of backfill materials placed and compacted. one test for every 1000 cubic yard of material placed and one test for each 1 foot vertical lift.

4) Other tests as may be required by Owner.

c. Required inspections:

1) Excavation inspection: Detailed inspection of exposed excavations prior to placing backfill material.

2) Placement and compaction inspection: Continuous inspection and monitoring.

2. Concrete: In accord with SSPWC Section 201-1.1.4 and as specified herein.

a. Portland cement: Furnish cement mill test reports and manufacturer's certification that cement complies with specification requirements.

b. Required tests:

1) Aggregate:

a) Hardrock aggregate: Test in accord with ASTM C 33.

b) Do not deliver aggregates to site or ready-mix plant until pit source has been approved, and plant, capacity, and ability to produce a uniform and continuous product has been verified.

c) Take samples from aggregate stockpiles assigned to project.

2) Slump tests: Make one slump test in accord with ASTM C 143 for each set of test cylinders: Make additional tests as may be ordered by Owner.

a) Make and keep an accurate record of all tests.

b) Maximum slumps: As specified hereinafter.

3) Test cylinders: Take one sample of four cylinders from each day's placement of 100 cubic yards or fractional part thereof of each mix design in accord with ASTM C 172. Take samples at evenly spaced

intervals as concrete is deposited in forms. Mark cylinders with date, sample number, and location in structure from which sample was taken. Do not take more than one sample of four cylinders from any location or batch of concrete.

a) Make and store cylinders in accord with ASTM C 31. Curing: At the end of 24 hours, take cylinders to laboratory and store under moist curing conditions at approximately 70°F until tested.

b) Testing: Test cylinders in accord with ASTM C 39. Test one cylinder at age of 7 days for information and two cylinders at 28 days for acceptance. Maintain one cylinder in reserve.

c) Seven-day strength: Not less than 60 percent of specified ultimate 28-day strength.

d) Mix adjustment: Should test results indicate concrete strength below specified 7-day or 28-day minimum requirements, decrease water/cement ratio and adjust mix proportions as necessary to achieve specified minimum strengths.

e) Concrete failures: Should test results indicate that concrete strength requirements for any portion of work does not conform to 28-day minimum requirements, secure core or prism specimens of hardened concrete and test in accord with ACI 301 and ASTM C 42.

f) Laboratory shall secure and test specimens under Owner's direction.

c. Ready-mix plant inspections:

1) Testing laboratory shall provide and maintain continuous inspection at plant to check sieve analysis for quality and moisture content of aggregates, check mix with design mixes, check cement being used with test reports, check loading of mixer trucks, and certify quantities of materials loaded in each mixer truck.

2) Certification: Provide batch tickets signed by dispatcher and testing laboratory inspector at ready-mix plant. Each batch ticket shall state batch quantities of cement, water, fine aggregates, coarse aggregates, and admixture contained in each truck load.

3) Deliver to Owner's representative on job site a properly signed ticket with each load of ready-mix concrete.

3. Reinforcing steel:

a. Quality control of identifiable steel:

1) Submit to laboratory copies of mill certificates for all types, sizes, and heats of reinforcing steel intended for use in the work. Include the following information:

a) Source of steel.

b) Description.
c) Heat number.
d) Yield point.
e) Ultimate tensile strength.
f) Elongation percentage in 8 in. length.
g) Bend test results.

2) Chemical analysis, including carbon equivalent (CE) of ASTM A 615 bars to be welded. All costs in connection with tests and inspections of identifiable steel will be paid by Owner.

b. Quality control of unidentifiable steel:

1) When steel cannot be identified, testing laboratory shall make one series of tensile tests and one series of bend tests in accord with ASTM A 370 or ASTM A 615, for each 5 tons or fractional part thereof of each size and kind of reinforcing steel. Make tests using a minimum of two separate samples. Test full sections of bars as rolled.

2) All costs in connection with tests and inspections of unidentifiable steel will be paid by Contractor.

c. Field quality control for welding:

1) Inspection and tests of welds shall be made by testing laboratory for reinforcing bar welds, as follows:

a) Certification of welders engaged in electric-arc welding of reinforcing.
b) Inspection of reinforcing bar welds.
c) X-ray test of one of the first arc-welds made by each welder; full penetration splice welds.
d) Two tensile tests of sample welds of the largest size bar for each type of welding.

2) Owner will pay all costs in connection with tests and inspections for welding of reinforcing steel splices when such welding is indicated on Drawings.

3) All costs in connection with tests and inspections for welding of reinforcing steel splices not indicated on Drawings will be paid by Contractor.

4. Payment:

a. Owner will pay all costs for all tests and inspections except retests and reinspections required because of failures.
b. All costs incurred for retests and reinspections required because of failure of original tests will be paid by Contractor.

C. Reference specifications and standards:

1. ACI: 301 Specifications for Structural Concrete for Buildings.
2. ACI: 305 Hot Weather Concreting.
3. ACI: 306 Cold Weather Concreting.

4. ASTM: A 370 Mechanical Testing of Steel Products.
5. ASTM: A 615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
6. ASTM: C 31 Making and Curing Concrete Test Specimens in the Field.
7. ASTM: C 33 Concrete Aggregates.
8. ASTM: C 39 Compressive Strength of Cylindrical Concrete Specimens.
9. ASTM: C 42 Drilled Cores and Sawed Beams of Concrete, Obtaining and Testing.
10. ASTM: C 143 Slump of Hydraulic Cement Concrete.
11. ASTM: C 172 Sampling Freshly Mixed Concrete.
12. ASTM: C 1107 Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
13. ASTM: D 1556 Density of Soil in Place by the Sand-Cone Method.
14. ASTM: D 1557 Moisture-Density Relations of Soils Using 10 lb. Rammer and 18 in. Drop.
15. ASTM: D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
16. ASTM: D 2937 Density of Soil In-Place by the Drive-Cylinder Method.
17. ASTM: E 1155 Determining Floor Flatness and Levelness Using the F-Number System
18. ASTM: F 609 Using a Horizontal Pull Slipmeter (HPS).
19. ASTM: F 1677 Using a Portable Inclineable Articulated Strut Slip Tester, (PIAST).
20. ASTM: F 1679 Using a Variable Incidence Tribometer, (VIT).
21. SSPWC: Standard Specifications for Public Works Construction ("Green Book").

1.06 SUBMITTALS

A. Procedure: In accordance with Division 01 Sections.

B. Shop drawings: Plans, elevations, sections, and details, including layout of components and accessories. Indicate dimensions, clearances required, utility service requirements, materials, and finishes.

C. Manufacturer's detailed technical materials data, including technical bulletins, drawings, guides, and manuals, as applicable to the work of this Project, for the following:

1. Admixtures.
2. Curing materials.
3. Joint materials.
4. Waterstops.
5. Metallic aggregate topping.
6. Nonshrink grout, including test data.

D. Certifications:

1. Cement mill test reports and certification.
2. Admixture certification, including chloride ion content.
3. Ready-mix batch plant tickets.
4. Reinforcing steel mill certifications.
5. Reinforcing steel welder's certifications.

E. Concrete mix designs: Submit, for approval, certified concrete mix designs for initial and any subsequent changes in mix designs.

1.07 PROJECT CONDITIONS

A. Existing conditions:

1. Do not conceal or cover any work until required tests and inspections have been performed and accepted.

B. Do not fabricate items which require fitting to other building elements or into building spaces, until dimensions have been verified at the site. Environmental requirements: Unless otherwise recommended by product or system manufacturer or reference specifications or standards, conform to the following:

1. Do not place concrete when the ambient temperature is 35°F or lower or is expected to go below that temperature within 24 hours.
2. Do not place concrete during rain that will cause surface damage to concrete.
3. Hot weather concreting procedures: In accord with ACI 305.
4. Cold weather concreting procedures: In accord with ACI 306.

C. Traffic control:

1. Maintain vehicular and pedestrian traffic control during concrete operations.
2. Provide flagmen, barricades, warning signs, and warning lights for movement of traffic and safety, and to cause the least interruption of work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete: In accord with SSPWC Section 201-1, Portland Cement Concrete, type as indicated on Drawings.

1. Cement: Conform to SSPWC Section 201-1.2.1.
2. Admixtures: Conform to SSPWC Section 201-1.2.4.
3. Fine aggregates: Conform to SSPWC Section 200 1.5.3
4. Coarse aggregates: Conform to SSPWC Section 200 1.4.
5. Design slumps and mix proportioning: SSPWC Sections 201-1.1.2 and 201-1.1.3 except as follows.
    a. Provide concrete which will develop the following minimum 28-day ultimate compressive strengths.
        1) Retaining walls and similar structural uses: 4000 psi.

B. Formwork: Wood or equivalent metal, conforming to SSPWC Section 303-1.3.

C. Reinforcement: Conform to SSPWC Section 201-2.

D. Curing materials: Liquid or equivalent sheet membrane, conforming to SSPWC Section 201- 4, except as specified herein.

E. Joint materials:

1. Construction joints: Preformed galvanized steel sheet or resawn wood.
2. Expansion joints: Premolded resilient filler, conforming to SSPWC Sections 201-3, except as specified herein.

F. Waterstops: Unless otherwise indicated on Drawings, provide extruded dumbbell type, spliced by thermal butt fusion.

G. Borrow material (for fill): Nonexpansive, predominantly granular material:

1. Particles less than 2 inches in any dimension;
2. Free of organic and inorganic debris;
3. Not more than 12 percemt by weight passing the No. 200 sieve.
4. Acceptable to a geotechnical engineer retained by Owner.

H. Non-shrink grout: Prepackaged, nonshrink, nonmetallic, natural aggregate grout conforming to ASTM C 1107, with minimum 28-day compressive strength of 5000 psi.

1. Hi-Flow or NS Grout by Euclid Chemical Company.
2. Five Star Grout by Five Star Products.
3. Master Flo 713 or 928 by Master Builders, Inc.

I. Integral mineral coloring pigments: Provide pure synthetic or natural mineral oxide colors as selected by Architect.

1. Chromix by L.M. Scofield Co., Longwood, FL, Los Angeles, CA.
2. Davis Colors, Beltsville, MD, Los Angeles, CA.
3. Lambco Colors by Lambert Corp. of Florida, Orlando, FL.
4. Landers-Segal Color Co., Inc., Passaic, NJ.
5. Solomon Colors, Springfield, IL.

PART 3 - EXECUTION

3.01 PREPARATION

A. Compact top 6 inches subgrade to 95 percent of the Modified Proctor maximum dry density.

B. Do not allow traffic over prepared subgrade.

C. Uniformly moisten subgrade at time concrete is placed. Uniformly apply water immediately prior to concrete placement.

D. Accurately trim to required elevations, allowing for full thickness concrete.

3.02 WALKS AND SLABS

A. Construct in accord with SSPWC Section 303-5, except finishing and curing of integral color concrete shall be as follows.

1. Finishing:

a. Tamp freshly placed concrete with approved metal grid tampers not less

than 12 inches by 12 inches in size so as to bring fines to top, then rod to uniform surfaces at required levels.

1) Float and trowel finish as soon as surface becomes workable.

2) Provide slopes as indicated on Drawings, or as directed by Architect.

b. During finishing maintain adequate surface moisture and reduce plastic shrinkage as recommended by integral color manufacturer.

1) Immediately after fresh concrete has been brought to a flat surface, a shiny film of moisture on top surface shall not be permitted to evaporate or as soon as the shiny surface disappears, it shall be restored and maintained until troweling.

2) Maintain surface moisture film as specifically recommended by integral color manufacturer applying evaporation retarder/finishing aids, frequent, light, fine spray applications of water rather than excessive wetting. Adjust extent of water spray in accord with temperature, humidity, and wind conditions.

c. Work concrete flatwork to achieve the following tolerances when measured in accord with ASTM E 1155.

1) Trowel finished surfaces: FF25/FL20 with minimum FF20/FL15.

2) Float and broom finished surfaces: FF20/FL17 with minimum FF15/FL10.

d. Surface finish textures:

1) Provide float, trowel, brush/broom, and/or abrasive-blasted surface textures to match Architect-approved sample panels.

2) Perform slip resistance testing to ensure that slip resistance of exposed concrete walking surface finishes is maintained. Follow testing procedures required for slip resistance testing of mock-up sample panels.

2. Curing: Cure, harden, and seal colored concrete flat slabs with compound(s) recommended by manufacturer of integral color concrete pigments. Curing, hardening, and sealing compound(s) shall not discolor, lighten, darken, stain, or impart other unsightly characteristics to colored concrete and shall be compatible with Owner's maintenance sealer.

B. Dumpster and compactor equipment pads and similar heavy-duty use areas indicated on Drawings: Apply bonding agent as recommended by topping manufacturer. Mix and apply extra heavy-duty, metallic-aggregate topping in accord with manufacturer's recommendations; unless indicated otherwise, provide minimum 1 inch topping thickness.

3.03 CURBS AND GUTTERS

A. Construct concrete curbs, gutters, and other similar structures in accord with SSPWC Section 303-5, except finishing and curing of integral color concrete shall be as specified herein for walks and slabs.

3.04 SITE STRUCTURES

A. Construct retaining walls, catch basins, manholes, valve and sump pits, thrust blocks, ductbanks, and similar structures to conform to requirements of SSPWC Section 303-1, Concrete Structures.

1. Formwork: Conform to SSPWC Section 303-1.3.
2. Placing reinforcing steel: Conform to SSPWC Section 303.17.
3. Placing concrete: Conform to SSPWC Section 303-1.8.
4. Consolidating (mechanically vibrating) concrete: Conform to SSPWC Section 303- 1.8.4.
5. Waterstops:
    a. Install accurately in the formwork. Securely fasten in place as recommended by manufacturer to prevent displacement during concrete placement.
    b. Use full manufactured length to avoid joints as much as possible.
    c. Thermally weld all joints and intersections in accord with manufacturer's instructions. Joints shall develop 85 percent (minimum) of tensile strength of section.
6. Construction joints: Unless indicated otherwise on Drawings, keyed type, conforming to SSPWC Section 303-1.8.6 and as specified herein.
7. Expansion joints: Unless indicated otherwise on Drawings, premolded resilient filler, conforming to SSPWC Sections 303-1.8.6.
8. Form removal: Conform to SSPWC Section 303-1.4.
9. Finishing: Conform to SSPWC Section 303-1.9.
10. Curing: Conform to SSPWC Section 303-1.10.

B. Additionally construct thrust blocks, ductbanks, and similar concrete structures related to other Divisions of work, in accord with requirements specified in applicable Sections and as indicated on Drawings.

3.05 JOINTS

A. Construction (pour) joints:

1. Place construction joints at all breaks in concrete placement lasting more than 1 hour and at color changes.
2. Unless otherwise indicated on Drawings, key construction joints for slabs 6 inches or more in thickness, except at expansion joints.

B. Expansion joints: Construct expansion joints with preformed resilient filler compatible with joint sealant materials, including joint backing, specified in Division 32 Section "Concrete Paving Joint Sealants".

C. Control joints:

1. Place control joints in all exterior flat concrete work, and other locations as indicated on Drawings.
2. Where control joints are not indicated on Drawings, verify specific types and

layout with Architect prior to placing concrete. Size and shape of layout is dependent on specific areas, but do not space control joints farther apart than 10 feet o.c. in a square pattern (e.g., if a concrete walk is 4 feet wide, control joint should occur at equal spacing of approximately 4 feet o.c. along length).

3. Control joints may be one of two types, as indicated on Drawings: Saw-cut or hand- tooled.

   a. Saw-cut:

      1) Use at slabs on grade only. Make saw-cuts 1/8 inch wide. Do not cut through steel bar reinforcing. Depth of all saw-cuts shall not be less than 1/4 of slab thickness.

      2) Verify hardness condition of concrete before commencing saw-cutting to ensure that saw will not fret, ravel, or spall edges of cuts nor dislodge aggregate. Use saw-cutting equipment appropriate for the hardness condition of concrete

   b. Hand tooled: Make control joints with a "V" shaped jointing tool with rounded edges and a 3/4 inch deep keel.

   c. Whether saw-cut or hand-tooled, accurately lay out areas and make control joints straight and true, with clearly defined angles.

4. Construction (pour) joints may be substituted for control joints where specifically approved by Architect.

3.06 PROTECTION OF COMPLETED WORK

A. During curing period, protect concrete from damaging mechanical disturbances, water flow, loading shock, and vibration.

-END OF SECTION-

SECTION 33 05 28
UNDERGROUND UTILITIES MARKING

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 SECTION INCLUDES

A. Underground warning tape for:

1. Electrical power duct banks.
2. Common user duct banks.
3. Potable and nonpotable water.
4. Reclaimed water.
5. Natural gas.
6. Sanitary and storm sewer force mains.
7. Compressed air.
8. Chilled water.
9. Irrigation mainline piping.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Division 31 Section "Excavation and Fill for Utilities".

B. Division 33 Section “Site Water Distribution System”.

C. Division 33 Section “Sanitary Sewer System”.

D. Division 33 Section “Storm Drainage System”.

1.04 QUALITY ASSURANCE

A. Reference specifications and standards:

1. ANSI: Z53.1 Safety Color Code for Marking Physical Hazards.

1.05 SUBMITTALS

A. Procedures: In accordance with Division 01 Sections.

B. Product data:

1. Manufacturer's detailed technical materials data, including technical bulletins, drawings, guides, and manuals, as applicable to the work of this Project.
2. For color coding of specific utilities not indicated on Drawings or not specified herein, submit samples of color coding tape markings for selection by Owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Marking tape:

1. Empire Level Manufacturing Corporation (Thor Enterprises), Mukwonago, WI. Tel: (800) 558-0722.
2. Mutual Industries North, Inc., Philadelphia, PA. Tel: (215) 927-6000, (800) 523-0888. 3. Reef Industries, Inc., Houston, TX. Tel: (713) 507.4250, (800) 231-6074.
4. Stranco Inc., Michigan City, IN. Tel: (219) 874-5221, (800) 348-3217.
5. T. Christy Enterprises, Inc. 655 E. Ball Road, Anaheim, CA. Tel: (714) 507-3300, (800) 258-4583.

2.02 MATERIALS

A. Marking tape: Reinforced or unreinforced type, 6 inches wide, inert, virgin resin, plastic film formulated for extended use underground, imprinted with an appropriate legend to define type of utility line it identifies.

1. Nondetectable: Minimum 4 mils overall thickness.
    a. DuraTec or ShieldTec by Empire Level Manufacturing Corporation (Thor Enterprises).
    b. Underground Tape (UT series) by Harris Industries, Inc.
    c. Non-Detectable Underground Marking Tape (No. 17783) by Mutual Industries North, Inc.
    d. Underground Warning Tape (PUWT-XXX series) by Stranco, Inc.
    e. Underground marking tape (No. TA-ND-6-GI) 6 inches non-detectable green irrigation marking tape by T. Christy Enterprises.
2. Detectable: Double-lamination/sandwich with continuous aluminum core, minimum 5 mils overall thickness. Provide manufacturer's splice clips or other accessory materials to maintain conductivity throughout entire length of tape installation.
    a. ThorTec or MagnaTec by Empire Level Manufacturing Corporation (Thor Enterprises).
    b. Underground Tape (DU series) by Harris Industries, Inc.
    c. Underground Detectable Tape (No. 17774) by Mutual Industries North, Inc.
    d. Detect-A-Line Detectable Underground Warning Tape (PUWT-XXXD series) by Stranco, Inc.
    e. Terra Tape Sentry Line 1350 by Reef Industries, Inc.
3. Color code: Black lettering on color backgrounds in accord with APWA/ULCC Uniform Color Code and ANSI Z53.1, except as follows.
    a. Red: Electric power ductbanks other than high voltage (e.g., 12 kV) electric power ductbanks.
    b. Yellow: Natural gas distribution and transmission.
    c. Orange: Common user ductbanks.
    d. Black or white lettering on blue background: Potable water systems.

e. Yellow lettering on purple background: Reclaimed water lines. Black lettering on green background: Irrigation mainline piping reading "CAUTION IRRIGATION LINE BELOW".

PART 3 - EXECUTION

3.01 INSTALLATION

A. Marking tape:

1. Nondetectable tape: Install over metallic utility lines.
2. Detectable tape: Install over nonmetallic utility lines.
3. For trenches which contain only one utility line, install one marking tape directly on top of each utility line (at the 12 o'clock position), install one additional tape 12 inches above the centerline of the utility line, and install one additional marking tape 18 inches to each side of centerline of utility line, a total of four utility marking tapes for a single common utility line in a single trench.
4. For trenches in common which contain more than one utility line, install one marking tape directly on top of each utility line (at the 12 o'clock position), install one additional tape for the proper utility 12 inches above the center of the utility line, and one additional marking tape for each utility in the common trench, installed 18 inches to each side of the edge of each of the outboard utility lines, a total of 8 utility marking tapes for 2 utility lines in a single common trench; a total of 12 utility marking tapes for 3 utility lines in a single common trench; a total of 16 utility marking tapes for 4 utility lines in a single common trench, etc.

-END OF SECTION-

SECTION 33 40 00
STORM DRAINAGE SYSTEM

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 SECTION INCLUDES

A. Storm drainage system includes:

1. Storm drainage pipe.
2. Catch basins.
3. Manholes.
4. Alteration of existing storm drainage structures.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Division 03 Section "Cast-In-Place Concrete".

B. Division 31 Section "Excavation and Fill for Utilities".

C. Division 33 Section “Underground Utilities Marking”.

D. Division 33 Section “Site Water Distribution System”.

E. Division 33 Section "Sanitary Sewage System".

1.04 QUALITY ASSURANCE

A. Tests and inspections:

1. Procedure: In accordance with Division 01 Sections.
2. Required tests:

a. Conduct leakage tests subsequent to alignment inspections and prior to flows being allowed in the line.
b. Test entire system for exfiltration in the presence of Owner. Limit leakage to 200 gallons per inch of pipe diameter per mile of length per 24 hours. Actual duration of test will be 4 hours.
c. Limit leakage to stated maximum limit, except that an allowance of an additional 10 percent of gallonage will be allowed for each additional 2 feet of head over a basic 2 feet minimum above pipe soffits.
d. Contractor shall be responsible to pay for leakage tests and required repairs and reconstruction.

B. Requirements of regulatory agencies: In addition to complying with other legal requirements, comply with CALTRANS Standard Specifications.

C. Reference specifications and standards:

1. AASHTO: Specifications for Highway Bridges.
2. AASHTO: M198 Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
3. ASTM: A 48 Gray Iron Castings.
4. ASTM: A 74 Cast Iron Soil Pipe and Fittings.
5. ASTM: C 76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
6. ASTM: C 94 Ready-Mix Concrete.
7. ASTM: C 150 Portland Cement.
8. ASTM: C 443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
9. ASTM: C 478 Precast Reinforced Concrete Manhole Sections.
10. ASTM: C 923 Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals.
11. ASTM: D 1248 Polyethylene Plastics Molding and Extrusion Materials.
12. ASTM: D 1784 Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds.
13. ASTM: D 2122 Determining Dimension of Thermoplastic Pipe and Fittings.
14. ASTM: D 2321 Underground Installation of Thermoplastic for Sewers and Other Gravity Flow Applications.
15. ASTM: D 2412 Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
16. ASTM: D 3034 Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
17. ASTM: D 3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
18. ASTM: F 477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
19. ANSI/AWWA: C105/A21.5 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
20. ANSI/AWWA: C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
21. ANSI/AWWA: C150/A21.50 Thickness Design of Ductile-Iron Pipe.
22. ANSI/AWWA: C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids.
23. CALTRANS: Standard Specifications.
24. Fed. Spec. SS-S-210a Preformed Plastic Sealing Compound for Expansion Joints and Pipe Joints.
25. SSPWC (Standard Specifications for Public Works Construction).

D. Allowable tolerances for manhole frames/drainage inlets and cleanouts:

1. Horizontal location: Within ±3 inches, in any direction, of horizontal location indicated on Drawings.
2. Vertical alignment: Not greater than 1/8 inch maximum tolerance for 6 feet of depth.

1.05 SUBMITTALS

A. Procedure: In accordance with Division 01 Sections.

B. Product data: Manufacturer's detailed technical materials, fabrication, and installation data, including technical bulletins, drawings, guides, and manuals, as applicable to the

work of this Project.

C. Certifications: Manufacturer's certification that pipe and fittings have been inspected and tested at the point of origin and are in compliance with specified requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pipe and fittings:

1. Polyvinyl chloride (PVC) pipe and fittings for main lines 15 inches and smaller: Conform to ASTM D 3034, SDR 26.

   a. Manufacture pipe from approved, Type 1, Grade 1, PVC 12454-C conforming to ASTM D 1784 and meeting requirements of ASTM D 2122 and ASTM D 2412.
   b. Pipe shall have integral wall thickened bells or extruded couplings with gasket seals. Solvent weld joints will not be permitted.
   c. Pipe joints shall be gasket push-on type complying with ASTM D 3212 and ASTM F 477.
   d. Pipe shall be UL/FM approved.
   e. Fittings shall conform to same specifications as pipe in which they are to be installed.
   f. Pipe shall be identified on exterior with the following information:

      1) Nominal pipe size and o.d. base.
      2) Material code designation number (12454C).
      3) Dimension ratio number (SDR 35).
      4) Pipe stiffness designation (PS46).
      5) ANSI/ASTM designation (D3034).
      6) Pipe manufacturer's name and production code.

2. Class II Reinforced Concrete Pipe (RCP) and fittings for main lines 16 inches and larger:

   a. Reinforced concrete pipe shall be manufactured in accordance with ASTM C-76, and shall be of the size and load classification shown on the plans. All reinforced concrete pipe shall be round rubber gasket type, centrifugally spun. Pipe shall be self-centering. The gasket or gaskets shall not be required to support the weight of the pipe. Mortar joint pipe is prohibited. Elliptical reinforcement will be allowed.

3. Cast iron soil pipe and fittings: Conform to ASTM A 74, service weight bell and spigot pipe with the following acceptable gasket types:

   a. Dual Tite.
   b. Rich-Seal.
   c. Ty-Seal.

B. Manhole frame, cover, and adjustment rings: Gray iron castings conforming to ASTM A 48 Class 30 and ASTM C 478.

1. Frames and covers shall be traffic bearing and capable of supporting H-20 loadings in accord with AASHTO Specifications for Highway Bridges.
2. Manhole frame, cover, and adjustment rings shall be as indicated on Drawings.
3. Concrete in-fill manhole covers, as indicated on Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION/PERFORMANCE

A. Excavating, trenching, backfilling, and compacting: In accord with Division 31 Section "Excavation and Fill for Utilities".

1. Pipe laying: Lay pipe as indicated on Drawings, as specified herein, and in compliance with applicable portions of ASTM D 2321. Grade trench bottom to indicated elevation of pipeline and shape bottom to fit lower quadrant of pipe. Excavate holes at each bell hub such that pipe will be uniformly supported along entire length of barrel only.
2. Pipe installation and jointing shall be in accord with pipe manufacturer's specifications and instructions for type of pipe used, and applicable requirements specified herein. Any pipe having a defective joint, bell, or spigot is unacceptable, shall be rejected, removed from site, and replaced with an acceptable unit.
3. Commence pipe laying in finished trench at lowest point, or from a point designated by Owner, and lay upgrade from point of connection with bell ends forward.
4. Install pipe to homing mark on spigot. On field cut pipe, provide a homing mark on spigot end in accord with manufacturer's recommendations.
5. Maintain pipe alignment and joint closure until sufficient haunching and backfill is in place to adequately hold pipe in position.
6. Prevent foreign materials from entering pipe while it is being placed in trench. Do not place debris, tools, articles of clothing, or other materials in pipe at any time.
7. As each length of pipe is placed in trench, assemble joints and bring pipe to intended line and grade. Bed and secure pipe in place.
8. When pipe laying is delayed for 10 minutes or more, close open ends of pipe using a watertight plug or other approved means to ensure that absolute cleanliness is maintained inside pipe.
9. At penetrations of manhole and similar structures, smoothly cut penetrating ends of pipe parallel to interior surface of structure. Maximum interior protrusion of pipe shall be the minimum necessary for proper sealing of pipe connection to structure. Use resilient connector when indicated on Drawings.

B. Pipe jointing:

1. Pipe installation and jointing shall be in accord with pipe manufacturer's specifications and instructions for type of pipe used and applicable requirements specified herein.
2. Ensure that interior of pipe and jointing seal is free of sand, dirt, trash, or other foreign materials before installation. Remove, clean, and re-lay pipe or fittings that have been installed containing dirt or other deleterious material. Extreme care

shall be taken to keep bells of pipe free from sand, dirt, or rocks so that joints may be properly assembled without overstressing bells.

3. Reinforced concrete pipe:

   a. Rubber gaskets:

      1) At all joints, except at penetrations of manhole and similar structures.
      2) Immediately prior to joining pipe sections, lubricate rubber gaskets using Owner-approved lubricant.

   b. Mortar joints: At all joints in accord with SSPWC Section 306 1.2.4 that fail initial leakage tests.

      1) Pipe larger than 27 inches diameter: Inner and outer surfaces of joints.
      2) Pipe 27 inches and less diameter: Outer surfaces of joints only.

3.02 FIELD QUALITY CONTROL

A. Alignment: Inspect storm drainage lines to determine if displacement of pipe has occurred during installation of bedding and compaction. Leakage: Conduct initial leakage tests. Failure to pass leakage test requirements shall require mortaring suspect joints as directed by Owner and subsequent leakage retests. Continued failure to pass leakage retests shall require removal and reinstallation of suspect pipe sections and replacement of suspect joint seals with new gaskets.

B. Correct, at no additional cost to Owner, sections of piping that are deficient in material, alignment, grade, or joints.

END OF SECTION 334000