SECTION 010120 - INTERPRETATION & PROCEDURE INSTRUCTIONS (RFI)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section contains the procedures to be followed by Contractor upon discovery of any apparent conflicts in the Contract Documents or upon having any question concerning interpretation.

1.3 PROCEDURES

A. Notification by Contractor:

1. Submit all Requests for Interpretation (RFI's) together with suggested solutions for changing the Contract Documents in writing to Architect using an approved form.
2. Number RFIs sequentially. All attachments or sketches shall contain a unique number related to the RFI number. A sketch provided with RFI 0001 would be labeled SK-RFI 0001.1.
3. Log: Maintain log showing status of RFIs and responses, and continuously update address status of RFIs regularly at scheduled project management meetings.
4. Limit each RFI to one subject.
5. Submit an RFI if one of the following conditions occur:

    a. Contractor discovers an unforeseen condition or circumstance that is not described in the Contract Documents.
    b. Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents.
    c. Contractor discovers what appears to be an omission from the Contract Documents that cannot be reasonably inferred from the intent of the Contract Documents.

6. Contractor shall not:

    a. Submit an RFI as a request for substitution.
    b. Submit an RFI as a submittal.
    c. Submit an RFI under the pretense of a Contract Document discrepancy or omission without thorough review of the Documents.
    d. Submit an RFI in a manner that suggests specific portions of the Contract Documents are assumed to be excluded or by taking an isolated portion of the Contract Documents in part rather than whole.

e. Submit an RFI in an untimely manner without proper coordination and scheduling of work of related trades.

7. If Contractor submits an RFI contrary to the above, Contractor pays the cost of all review, with cost deducted from the Contract Sum.
8. Submit request for information or clarification immediately upon discovery. Submit RFIs within a time frame so as not to delay the Construction Schedule while allowing the full response time described below.

B. Response Time:

1. Architect will resolve such questions and will issue instructions to Contractor within a reasonable time frame. In most cases, RFIs will receive a response within 10 working days. If in the opinion of Architect more than 10 working days is required to prepare a response to an RFI, Contractor will be notified in writing.
2. Should Contractor proceed with the work affected before receipt of a response from Architect, within the response time described above, any portion of work which is not done in accordance with Architect's interpretations, clarifications, instructions, or decisions is subject to removal or replacement and Contractor responsible for all resultant losses.

END OF SECTION 010120

SECTION 011000 - 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. This Section includes the following:

1. Project information.
2. Work covered by the Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Specification and drawing conventions.

1.3 PROJECT INFORMATION

A. Project Identification: Lakers Practice Facility, Los Angeles, California.

1. Project Number: 2014-015.

B. Architect: Rossetti Associates, Inc., 160 West Fort, Suite 400, Detroit, Michigan 48226.

1. Telephone: (313) 463-5151.
2. Fax: (313) 463-5160.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. Type of Contract:

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

1.5 ACCESS TO SITE

A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises 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 premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways and Entrances: Keep driveways, parking garage, loading areas, and entrances serving premises clear and available to building occupants, 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. Respect normal use by all building occupants.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
2. Obtain a Certificate of Occupancy from Authorities Having Jurisdiction (AHJ) before Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.7 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 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

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. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.

B. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 2 - PRODUCTS

2.1 Refer to Sheet G-003.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

END OF SECTION 012100

SECTION 012300 - ALTERNATES

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. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

PART 2 - PRODUCTS

2.1 Refer to Sheet G-002.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012300

SECTION 012600 - CONTRACT MODIFICATION 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. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, as "Architect's Supplemental Information (ASI)."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests (PR) issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 016000 "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive (CCD). Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 013100 - 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. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Project meetings.

1.3 COORDINATION

A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with 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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

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. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

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

1.4 PROJECT MEETINGS

A. General: 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 Architect of scheduled meeting dates and times.
2. Agenda: Contractor shall prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner, Contractor, and Architect, but no later than fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Contractor, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. 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. Procedures for processing field decisions and Change Orders.
    f. Procedures for requests for information (RFIs).
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of the Contract Documents.
    j. Submittal procedures.
    k. Preparation of Record Documents.
    l. Use of the premises.

m. Work restrictions.
n. Owner's occupancy requirements.
o. Responsibility for temporary facilities and controls.
p. Construction waste management and recycling.
q. Parking availability.
r. Office, work, and storage areas.
s. Equipment deliveries and priorities.
t. First aid.
u. Security.
v. Progress cleaning.
w. Working hours.

3. Minutes: Contractor will record and distribute meeting minutes.

C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction, as indicated elsewhere in the specifications (Division 2 thru 16).

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 Architect and Owner 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. The Contract Documents.
b. Options.
c. Related Requests for Information (RFIs).
d. Purchases.
e. Deliveries.
f. Submittals.
g. Review of mockups.
h. Possible conflicts.
i. Compatibility problems.
j. Time schedules.
k. Weather limitations.
l. Manufacturer's written recommendations.
m. Warranty requirements.
n. Compatibility of materials.
o. Acceptability of substrates.
p. Temporary facilities and controls.
q. Space and access limitations.
r. Regulations of Authorities Having Jurisdiction (AHJ).
s. Testing and inspecting requirements.
t. Installation procedures.
u. Coordination with other work.
v. Required performance results.
w. Protection of adjacent work.
x. 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 parties who should have been present.

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. Progress Meetings: Contractor shall conduct progress meetings at a reasonable interval for the project scope. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner, Contractor, and Architect, 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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. 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) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of correction of deficient items.
        14) Field observations.
        15) Requests for information (RFIs).
        16) Status of proposal requests.
        17) Pending changes.
        18) Status of Change Orders.
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.

3. Minutes: Contractor will record and distribute to Contractor the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

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 013100

SECTION 013300 - SUBMITTAL 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 submitting Submittals Schedule, Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit three (3) copies of 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 modifications to submittals noted by the Architect 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 start-up 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.

    a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

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. Submittal category: Action, informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.
    i. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project Record Drawings.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Contractor shall execute a data licensing agreement in the form of an Agreement form acceptable to the Owner and Architect.
    c. The following files will by furnished for each appropriate discipline:

        1) CAD floor plans, Grid plans.
        2) Reflected ceiling plans.
        3) REVIT models.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. 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 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 10 working days for review of each resubmittal.

D. Identification and Information for Shop Drawings: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Name of subcontractor.
g. Name of supplier.
h. Name of manufacturer.
i. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number. Resubmittals shall be identified as such and shall note the previous submittal number on the Transmittal/ Data Sheet.

j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Other necessary identification.

E. Options: Identify options available, requiring selection by the Architect. If Contractor has not made edits, it shall be assumed that all options are available for Architect to select at no additional cost.

F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals. All resubmittals shall also bubble specific changes to the previous submittal as well.

G. Digital Submittals: All submittals including shop drawings and product data shall be submitted as PDF files and posted for review by the Architect.

H. Additional Paper Copies (PHYSICAL and COLOR SAMPLES ONLY): Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit number of samples needed plus one for Architect's record.
2. Additional samples submitted will be returned upon review for Contractor's Use. Contractor shall maintain Owner's copy as well.

I. Contractor Review: Contractor to review and sign all submittals prior to transmittal to Architect - See Part 3 - EXECUTION.

J. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a Transmittal/Data Sheet form.

1. Transmittal/Data Sheet Form: Use template provided by Architect.
2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

K. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Approved" or "Approved as Noted".
4. Cloud or highlight revisions. All other content will be assumed to be unchanged from the original submittal.

L. Distribution: Furnish digital PDF copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

M. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved as Noted" by Architect.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Action Submittals (SAMPLES): Submit three paper copies of each submittal, unless otherwise indicated. Architect will return two copies.
2. Action Submittals (SHOP DRAWINGS, PRODUCT DATA): Submit Digital PDF Files of the requested information. Architect will return PDF with comments only.
3. Informational Submittals: Submit Digital PDF Files of the requested information. Architect will not return copies unless an issue is noted.
4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
6. Test and Inspection Reports Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.
    j. Standard product operation and maintenance manuals.
    k. Compliance with specified referenced standards.
    l. Testing by recognized testing agency.
    m. Application of testing agency labels and seals.
    n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Architect's CAD Drawings are otherwise permitted. Shop Drawings that are not based on the specific project (boiler-plate drawings) will be returned to the Contractor as "Not Reviewed".

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements (including necessary clearances).
    l. Notation of dimensions established by field measurement.
    m. Relationship to adjoining construction clearly indicated.
    n. Seal and signature of professional engineer if specified.
    o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (216 by 279 mm) but no larger than 30 by 40 inches (762 by 1016 mm). Provide clear space on all associated drawings sheets for review stamps of the Contractor, Architect and related Consultants, failure to provide clear space may result in submittal being returned as "Not Reviewed".

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
2. Manufacturer and product name, and model number if applicable.

3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule as a Digital PDF File.

F. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Submit subcontract list as a Digital PDF File.

G. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

H. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on American Welding Society (AWS) forms. Include names of firms and personnel certified.

I. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

J. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

K. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

L. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

M. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

N. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

O. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.

4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

P. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."

Q. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

R. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

S. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

T. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

V. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

W. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service 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.

X. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. A= Approved.
2. AN= Approved as Noted, (Resubmission not Required)
3. RR= Not Approved. Revise and Resubmit.
4. NR= Not Reviewed.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

NOTE: THIS IS A BLANK VERSION. A PROJECT-SPECIFIC COPY NEEDS TO BE PROVIDED

ROSSETTI

160 WEST FORT, SUITE 400
DETROIT, MICHIGAN 48226
313.961.5151
ATTN: TROY

Address
City, state, zip
Phone
ax

SUBMITTAL DATA SHEET / TRANSMITTAL

Project _____ RA Job No. _____ Control No.

Subcontractor or Vendor _____

Project Manual Section No. _____ Resubmittal: _____

SUBMIT A SEPARATE FORM FOR EACH PROJECT MANUAL SECTION

Contr/CM Control No.	RA Control No.	Subm'l Type	Qty	Description	Review Code

☐ Interior ☐ Structural ☐ Mechanical ☐ Electrical ☐ Civil ☐ Other:_____

Contractor/ CM Comments:

By: Date:

Contractor certifies by signature that this submittal has been reviewed and approved in accordance with the General Conditions of the Contract. Failure to provide signature will result in submittal being returned to the Contractor / CM marked "Not Reviewed".

Consultant Comments:

By: Date:

ROSSETTI Comments:

By: Date:

Code	Description
A	Approved
AN	Approved as noted
ANR	Approved as noted, Resubmit
RR	Not Approved / Revise & Resubmit
NR	Not Reviewed, See comments above

Submittal Type

SD	Shop Drawing	PD	Product Data	RP	Record Purposes Only
S	Samples	CO	Color Samples	(see section 01300 for other types)	

Distribution

- Owner ☐
- Contractor ☐
- Consultant _____ ☐
- Consultant _____ ☐
- ROSSETTI File ☐
- ☐

Received from Sub-Contr. (date)

Sent to Architect (date)

Received by RA (stamp)

Sent to Consultant (date)

Received by Consultant (stamp)

Received by RA (stamp)

Returned to Contr/CM (date)

Contr/CM Rec'd from RA (stamp)

Returned to Sub-Contr. (date)

jobintial/No.doc

SECTION 013700 – BUILDING INFORMATION MODELING (BIM) PROJECT REQUIREMENTS

PART 1 - GENERAL (NOT USED)

PART 2 - BUILDING INFORMATION MODELING / MANAGEMENT

2.1 BUILDING INFORMATION MODELING / MANAGEMENT - DEFINITIONS

A. Base Structural Model – the structural steel mill order drawing file showing all structural elements. This model is not necessarily fully detailed with all connections.

B. Base Architectural Model – a combination of the Base Structural Model and key architectural elements. This model is to be used by all coordination participants as the background file in which to develop their work. Information within this model will be updated through RFI responses and the coordination process. This model is for reference only.

C. Base Composite Model – this model includes all trade model files within the Base Architectural Model as a representation of the completed systems. This model is used to run the intermediate clash reports and is considered a work in progress.

D. Final Coordination Model – this model shows all trades' systems fully coordinated models within the Base Architectural Model. All clashes have been resolved. No further coordination is required. The work shown within this model represents the upcoming installations of each system.

E. Completed Coordination/Record Model – this model is the close-out submittal to the Owner and includes the information within the Final Coordination Model as well as any project updates that have taken place during installations such as RFI responses, as-built conditions, etc.

F. PDF – Portable Document Format – When referred to elsewhere in the specifications a PDF shall refer to a portable document format which meets the following requirements:

1. Bookmarked – All PDF's shall have established bookmarks for ease of navigation
2. Hyperlinked – All PDF's which are large scale drawings shall utilize hyperlinks to reference pages within the document or other PDF's with the file folder which are made reference through one of the following mechanisms: sections, elevations, details etc.
3. Original PDF format – All PDF documents shall be natively printed to PDF from the original document. i.e. faxed documents will not be accepted (with the exception of scanned)
4. Digital Signature – All contractors shall have the ability to digitally sign and certify PDF documents and shall do so where required by the specifications.

2.2 BUILDING INFORMATION MODELING / MANAGEMENT – GENERAL REQUIREMENTS

A. A Coordination model produced using Building Information Modeling software is to be developed by all BIM participants. This model will be utilized to establish field installation sequence, resolve trade coordination issues prior to installation, and to make the most efficient use of installation space without sacrifice to system performance for mechanical, electrical, structural and assigned architectural systems. This method will use multiple BIM design review software platforms as a means of documenting, identifying and resolving inter-relationships and possible interferences between all trades' Work and the architectural features as using the model to schedule, provide quantity takeoffs and serve as the as-built of the facility.

B. Communication is a critical element to the success of this coordination process. Each Subcontractor, the Design Team Members, the Owner, and General Contractor/CM must be in constant communication to keep the process moving forward in a timely manner and per the sign-off schedule. Constant collaboration is expected of all team participants and each participant should be proactive in identification and resolution of the design engineering and model interferences.

C. General Contractor/CM will facilitate and lead the BIM Process. General Contractor/CM will be the final authority on model issues. It is the responsibility of all BIM participants to resolve discrepancies pertaining to their own model. Each Subcontractor shall purchase at its own cost licenses of Navisworks 2014 including any maintenance and software updates during the course of the Project.

D. All BIM participants are required to attend all model review meetings, are expected to be active participants and have the expertise and authority to resolve coordination issues to produce a clash-free, information loaded model. Provide sufficient detailing manpower to meet the BIM milestones for level of development as shown on the attached Exhibit 1 Table. Required coordination participants include:

1. Site Utilities
2. Reinforcing steel
3. Concrete Foundations and SOG including reinforcing steel
4. Masonry
5. Structural Steel and Stairs
6. Miscellaneous Metals – Interior and Exterior (railings)
7. Architectural Millwork/Casework
8. Metal Panels
9. Curtainwall System
10. Metal Studs and Ceilings (ACT and Studs)
11. Kitchen Equipment
12. Grandstand System
13. Elevators
14. Fire Protection and Equipment
15. Mechanical Plumbing & Piping and Equipment
16. HVAC Systems and Controls and Equipment
17. Electrical System and Equipment (primary)
18. Electrical System and Equipment (building)
19. Low Voltage System and Equipment

E. A Mandatory BIM Kick-Off Meeting for all participants will be set up to review:

1. Team Collaboration
2. The execution process

3. Coordination schedule
4. Establishing standard zones per system
5. Use of the model during construction
6. Project specific information and requirements
7. Model / Document standards

F. General Contractor/CM will subdivide the project into coordination areas and establish a model flow for each specific area. It is required that all contractors model around previously developed models and submit only clash-free models. For example, structural steel detailing will fully detail an area. The combined structural model will then be forwarded to the mechanical contractor for duct detailing. It is expected that the mechanical contractor model around the previously developed models to produce a clash-free model.

G. Weekly BIM Development Meetings will be held with all participants to review the model progress per the schedule and process indicated below:

1. Posting of files to the web-based posting site shall be at least weekly.
2. Refer to the Exhibit 1 Table following this section to include

    a. Completion milestones for each area
    b. Sequence of drawing

H. Typical utility corridors and above ceiling space zones for each trade will be established by the group at the beginning of the process. These zones will be adjusted through the coordination process to meet actual installation requirements during system development.

I. All participants are required to identify those submittals required for accurate detailing of the coordination model (such as equipment, light fixtures, etc.) and are to make those submittals a priority in obtaining final approval so the specific information can be incorporated into the modeling process.

J. All BIM participants are required to produce a BIM with all information typically included on their shop drawings. BIM may not replace the standard submittal process and all contractors will be required to produce 2D shop drawings from their BIM as requested.

K. At the Weekly BIM Development Meeting:

1. The purpose of the Weekly BIM Development Meeting is the review and resolution of items that are found as models are developed in conjunction with the project schedule. The meetings will focus on clashes that cannot be resolved by internal collaboration, additional information that needs to be placed with model objects to support scheduling and estimating goals, and / or review of design changes to be incorporated. General Contractor/CM will facilitate the meeting and will make final decisions on clash resolution that are the least impact to the project as a whole. WEEKLY BIM DEVELOPMENT MEETINGS WILL NOT BE USED TO RESOLVE INDIVIDUAL SUBCONTRACTOR'S WORK. If a Subcontractor does not post a clash-free system of its own work, that Subcontractor will be considered unprepared for the meeting and will be responsible for any delays to the project schedule and any associated costs due to that delay.
2. Each BIM participant shall review the Base Composite Model and utilize clash detection BIM software capable of combining and reviewing all sub-models from other participants in order to clean-up any simple clashes that can be made without review by all participants.

3. All BIM participants are expected to be prepared for the meeting with new models of the next area to be coordinated per the project schedule. Issues, including, but not limited to, design and owner requested changes, space issues, and potential conflicts should be identified by each contractor's modeler. Each participant shall have available any shop model, submittals or other materials required to solve identified or potential conflicts.
4. It is expected the coordination schedule will be maintained and all potential and identified conflicts are addressed and resolved per that schedule.
5. All agreed upon corrections to issues and potential conflicts determined by the team at the BIM Development Meeting are to be updated and resolved prior to the next meeting.

L. When an area of the model is fully coordinated, each participant agrees:

1. Through active participation at the Coordination Meetings that each trades' work is fully coordinated and the associated field installation will be solely per the model and not in conflict with any other trade or system.
2. The Final Coordination Model is to be referred to for resolution of all field installation issues and RFIs. No extra compensation will be paid for relocating material whose installation deviates from the Final Coordination Model. If any deviation is found, that installing Subcontractor is responsible for the full correction of the work including costs incurred by other affected Subcontractors and/or costs borne by the responsible Subcontractor.
3. The Model is not considered to be the Final Coordination Model until the A/E and Owner has approved all systems and routings.

M. Should a conflict arise during installation that was not foreseen or solved during the coordination effort, each BIM participant will work together with General Contractor/CM to find a solution that is the least impact to all trades and the project. The cost of this work will be evaluated as the problems arise, however, the party responsible for the conflict will be responsible for the cost of the fix, including the additional detailing time of all parties involved.

N. The Final Coordination Model shall be kept up to date by all participants during construction to include any project updates including as-built information and documents and be submitted to General Contractor/CM electronically in IFC, WRL, or native file format and PDF form on a rolling basis. In coordination with the Supply Chain Requirements, items to be included in these files includes:

1. User Defined Attributes (UDA's), which are set-up within each respective BIM model for every object, must contain Supply Chain Requirements (submittal approved, material installed etc.), Equipment attributes (name, location etc.), Commissioning phases (pre-commissioning, functional performance test, system start-up, equipment acceptance), Manufacturer Information (name, address, contact etc.), and Warranty/Service Information (warranty, service contact etc.).
2. RFI responses are required to be incorporated into the base models when design changes are necessary.
3. Submittal documentation will be uploaded via FTP by all subcontractors.
4. All documentation submissions must be in PDF form.
5. The BIM will be used as an as-built for the facility. Each BIM participant is required to provide a fully updated BIM of that participant's system incorporating all as-built conditions and any field changes.

O. Participants not attending one or multiple BIM Development Meetings, or failing to post their model files per the Schedule, will relinquish the right to request changes to the model in an effort to coordinate their own work, and will execute their Work without impact to the Work coordinated at the meeting. Should this not be possible, the offending participant who has not met the Coordination Schedule will be responsible for any additional meeting time and/or the costs associated with delaying the model development.

P. A professional code of conduct is assumed of all participants. All participants' documentation will be available on the designated web-based posting site for reference by the other participants. Drawing files shall never be tampered with by non-owners of the file. If a mistake occurs and a drawing is inadvertently changed, the responsible party is required to alert all others immediately.

Q. Representatives of both the Design Team and Owner may attend the BIM Development Meetings and will be authorized to assist in the resolution of clashes from a design perspective to expedite the process. The General Contractor/CM may request a change be submitted as an RFI and that process will be followed. When submitted, the RFI must clearly state the problem, possible solutions and benefits to the project.

2.3 BUILDING INFORMATION MODELING / MANAGEMENT – SCHEDULE

A. The General Contractor/CM shall develop a BIM schedule as part of the master construction schedule development, major milestones should be included.

2.4 BUILDING INFORMATION MODELING / MANAGEMENT - DETAILING REQUIREMENTS OF ALL PARTICIPANTS

A. A folder system will be established by General Contractor/CM on the FTP site to be used by all coordination participants. The folder use and structure includes:

1. Progress Drawing Folder – As each coordination participant makes progress to his model, the drawing files shall be posted and maintained in this folder. These files are then made available to the other coordination participants for reference during their drawing progress. These files will not be used in the generation of the Base Composite Model and uploaded into the design review software prior to a scheduled coordination meeting.
2. Postings Folder – prior to each Coordination Meeting as per the schedule, post all progress drawing files here. These are the files that will be uploaded into the Base Composite Model for review. There should be one file per trade per coordinate area currently being coordinated. As additional areas of the are modeled and coordinated, the previous areafile shall be over-written and posted here. Refer to the standard file naming conventions listed below.
3. Completion Folder – once an areais fully coordinated and clash free, the final coordinated drawing file shall be posted to this folder. These are the files will be used for the Final Coordination Model. Shop drawings shall be produced with annotations from this model, see article 2.4/E.
4. For ease of use by all coordination participants, a naming convention will be utilized. The naming convention is as follows Year_Month/Day Name. For example: 2013_0429 Structural Model Quad 1. All participants will be required to utilize this naming convention.

5. All coordination participants are to maintain a current control copy of their own drawing files outside of the project's cloud based posting site.

B. Only Naviworks 2014 compatible file types must be used for compatibility of all drawing postings. No other file types will be accepted.

C. The common coordinate system will be defined by ROSSETTI and distributed to all participants to use as a background to detail their work around. The origin point must not change as it will affect the collation of the files into the Base Composite Model. No drawing work shall take place until this point is agreed upon by the team.

D. When posting model files for coordination:

1. Model files must be sent with all necessary layers or items thawed and necessary model elements visible. All model files will be uploaded into the Base Composite Model in the state they were sent.
2. Provide only individual contractor model space information. Elements from other contractor's model inserted for reference must be deleted.
3. Posted model files should be of each Subcontractor's system that is clash-free with its own work. The only work that should be shown is elements to be installed in the field.
4. These files should be void of any text, dimensions or any other notations. All text, annotations and dimensions can be placed on a separate layer from model entities; for general coordination postings, this layer shall be deleted.

E. Each BIM Development participant is required to submit (1) complete set of shop drawings prior to any work being installed in the field. These complete drawings are to be fully dimensioned and notated. It is required that the subcontractor using a BIM program capable of producing these shop drawings from their model. Items to be noted in the final, fully coordinated drawing paper and electronic file versions of each system include:

1. Bottom and top elevations of duct, duct insulation, pipe, conduit racks, hangers, cable trays etc. must be indicated (where applicable).
2. Dimensions shall be shown from the gridlines to the centerline of each element drawn (round duct, pipe, cable tray, etc.) and from finished floor
3. Height to top of light housing assembly must be indicated.
4. Labeling of all equipment tags.

F. During the BIM Development effort, priority will be given to those systems that have the least flexibility. The following list is a descending order of the system priority and shall be used as a general guideline. Throughout the coordination drawing effort, adjustments and deviations to this list can be made with the approval of General Contractor/CM. 0'-6" clear above the ceiling shall be maintained for access and construction of the ceiling. Required maintenance and/or code access spaces and set-backs take precedence over all systems.

1. Steel framing
2. Gravity Pipe: plumbing waste, roof drainage, steam condensate return and other systems that rely upon gravity for flow
3. Ductwork and appurtenances, except bracing which shall be relocated to accommodate local interferences
4. Cable tray
5. Fire protection piping and fixtures
6. Bus duct
7. Recessed light fixtures

8. Electrical conduit over 2” in diameter
9. HVAC piping
10. Plumbing vent, supply and medical gas piping
11. Electrical conduit smaller than 2” in diameter
12. Above ceiling miscellaneous metal supports
13. Access to kitchen equipment hoods

G. See attached Exhibit 1 for model Level of Development (LOD) requirements for each BIM at each stage of the project.

H. See attached Exhibit 1 Table for the specific project elements that each BIM participant, or Model Element Author (MEA), is responsible for modeling. This table also provides the required Level of Development at each stage in the project. In situations where multiple BIM participants are shown as responsible for a specific element, the Model Element Author shown at each stage is merely the participant whose model will be considered official for use in the Base Composite Model at that stage. It is required that each Model Element Author begin modeling before their model is the official and that each Model Element Author continuing modeling to an as-built condition.

PART 3 - SUPPLY CHAIN MANAGEMENT

3.1 SUPPLY CHAIN MANAGEMENT - DEFINITIONS

A. Supply Chain Management: Supply Chain Management (SCM) is the management of a network of interconnected Project Stakeholders (Design Team, Owner, General Contractor, Vendors, and Subcontractors) involved in the provision of products, materials and/or services required to satisfy the Project Requirements ultimately resulting in the completion of the Project.

B. Information Supply Chain Management: Information Supply Chain Management (ISCM is the management of the creation, submission, review and approval of information, e.g. submittals, shared between Project Stakeholders.

C. Physical Supply Chain Management: Physical Supply Chain Management (PSCM) is the management of the manufacturing, fabrication, shipping, installation, inspection and QA/AC of products, materials and/or services required to satisfy the Project Requirements and ultimately the completion of the project.

D. Comma-Separated Values File: A comma-separated values (CSV) file stores tabular data (numbers and text) in plain-text form. Plain text means that the file is a sequence of characters, with no data that requires interpretation, as binary numbers would require. A CSV file consists of any number of records, separated by line breaks of some kind. Each record consists of fields, separated by commas. For this Project, a CSV file is the minimum acceptable means of communicating Supply Chain Management information digitally.

E. API Integration / Direct Integration: An API (Application Programming Interface) or Direct Integration are technical implementations used as an interface by software solutions to communicate with each other. For this Project, an API or Direct Integration is the preferred means of communicating Supply Chain Management information digitally if such an interface is available.

F. Control Number: A Control Number is a unique identification number within a particular project for a particular building system; Control Numbers need not be globally unique. Control numbers should be a short as possible and should be easily understood by simply reading them, e.g. 1, 2, 3, etc. Control Numbers may also have meaning if required, e.g. AHU-6.

G. Bay Control Number: A Bay Control Number is a unique identification number within a particular project to indicate the location of a 2-dimensional area of risers, aluminum, seat attachments, handrails and seats.

H. Barcode: A Barcode is an optical machine-readable representation of data relating to the object to which it is attached. Every effort should be made to utilize Barcodes already in use in the Supply Chain or Barcodes that have meaning without being read by a machine.

I. Assembly Mark: An Assembly Mark is the identification number assigned to sufficiently like Structural Steel objects during the detailing process. These marks are used to aid in the management of detailing, fabrication and erection process. They are only unique to the Structural Steel assemblies to which they are assigned within the Project.

J. Cast Unit Mark: A Cast Unit Mark is the identification number assigned to sufficiently like Concrete objects during the detailing process. These marks are used to aid in the management of detailing, fabrication and construction of Concrete. They are only unique to the Concrete assemblies to which they are assigned within the Project.

K. Pile Cap Number: A Pile Cap Number is the identification number used to describe like pile caps within the Project.

L. Service Area: Service Area is the area served by an elevator.

M. Section: Section is the section served by an elevator.

N. Equipment Number: Equipment Number is the unique number assigned to a piece of equipment. Equipment Numbers should be as short as possible and should be easily understood by simply reading them. Equipment Numbers may also have meaning if required, e.g. AHU-6.

O. System Number: System number is the unique number assigned to a group of infrastructure objects, e.g. pipe, duct, conduit, wire, etc. System Numbers should be as short as possible and should be easily understood by simply reading them. System Numbers may have meaning if required, e.g. MECHDUCT-7.

P. Grid Location: A Grid Location is the location at which two column grid lines intersect each other. The Grid Location is represented by listing both designations together, e.g. C1. A Grid Location can also be two Grid Locations separated by a dash to represent that a particular object is spanning these two grid intersections.

Q. Software ID: A Software ID is the identification number arbitrarily assigned to an object by a software application. Software IDs are not globally unique and are only unique to objects within a particular file or database.

R. BIM ID: A BIM ID is the identification number arbitrarily assigned to an object by a BIM application. BIM IDs are not globally unique and are only unique to objects within a particular Building Information Model.

S. Tekla ID: A Tekla ID is the identification number arbitrarily assigned to an object by Tekla BIM software. Tekla IDs are not globally unique and are only unique to objects within a particular Building Information Model.

T. Software GUID: A globally unique identifier (GUID) is a unique reference number used as an identifier in software. GUIDs are created using a randomization algorithm to generate hexadecimal numbers that are so large that the chance of generating the same number twice is negligible.

U. BIM GUID: A globally unique identifier (GUID) is a unique reference number used as an object identifier in BIM software. GUIDs are created using a randomization algorithm to generate hexadecimal numbers that are so large that the chance of generating the same number twice is negligible.

V. Tekla GUID: A Tekla globally unique identifier (GUID) is a unique reference number used as an object identifier in Tekla BIM software. GUIDs are created using a randomization algorithm to generate hexadecimal numbers that are so large that the chance of generating the same number twice is negligible.

W. BMC Schedule Activity ID: The Barton Malow Company (BMC) Schedule Activity Identifier (ID) is the reference number used to uniquely identify each schedule activity for the Project.

X. Graphical Summary Area: A Graphical Summary Area is a designation of a 2-dimensional space represented either in the Design Documents or the Project schedule. It can also be a collection of Areas.

Y. Area: An Area is a designation of a 2-dimensional space represented either in the Design Documents or the Project schedule.

Z. Vertical Level: The Vertical Level is a designation based on elevation as indicated in the Project's design documents and utilized in the Project's schedule.

AA. Room ID: Room ID is a unique number assigned to a room or space within the project.

BB. Assembly Name: An Assembly Name is a text description of a Structural Steel assembly, e.g. Column, Beam, Brace, etc.

CC. Name: A Name is a text description used to describe an object, e.g. Pile Cap.

DD. System Name: A System Name is a text description used to describe a group of infrastructure objects, e.g. Mechanical Duct, Electrical Conduit, etc.

EE. Weight: The Weight of an object in pounds that is managed in the Supply Chain.

FF. Volume: The Volume of a concrete object in cubic yards.

GG. Height: The Height of an object in decimal feet.

HH. LF: The Linear Footage (LF) of an object in decimal feet.

II. SF: The Square Footage (SF) of an object in decimal feet.

JJ. Fabrication Phase: The Fabrication Phase is the phase designation used by the Fabricator, for its own purposes, to express the current supply chain state.

KK. Fabrication Sequence: The Fabrication Sequence is the designation used by the Fabricator, for its own purposes, to express which fabrication grouping an object belongs.

LL. Fabrication Load: The Fabrication Load is the designation used by the Fabricator, for its own purposes, to express which material load grouping an object belongs.

MM. Fabrication Lot: The Fabrication Lot is the designation used by the Fabricator, for its own purposes, to express which shipping group an object belongs.

NN. Fabrication Location: The Fabrication Location is the designation used to identify from which manufacturing facility has originated or will originate.

OO. Coating Location: The Coating Location is the designation used to identify from which coating facility an object has been coated or will be coated.

PP. Rebar Location: The Rebar Location is the designation used to identify from which rebar fabrication facility rebar will originate or has originated.

QQ. Stringer Location: The Stringer Location is the designation used to identify from which fabrication facility stringers will originate or have originated.

RR. Aluminum Location: The Aluminum Location is the designation used to identify from which fabrication facility stringers will originate or have originated.

SS. Handrail Location: The Handrail Location is the designation used to identify from which fabrication facility handrails will originate or have originated.

TT. Storage Location: Storage Location is the designation used to identify where equipment is stored after fabrication is complete and before it is deliver to the Project site.

UU. Origin: The location from which infrastructure objects originate.

VV. Rig Number: The Rig Number is the unique identifier for each rig used on the Project.

WW. Crew: A Crew is a group assigned to a particular work task.

XX. Layout: Layout is the date upon which the necessary positioning information has been physically placed at the project site to complete the installation or construction of an object in the Supply Chain.

YY. Form: The date upon which concrete formwork for a concrete element has been installed.

ZZ. Anchor Bolts and Embeds: The date upon which Anchor Bolts and Embeds have been laid out and installed prior to concrete placement.

AAA. Wreck: The date upon which concrete formwork has been removed after concrete placement.

BBB. Drill: Drill is the date upon which an auger cast pile or a group of auger cast piles have been drilled.

CCC. Reinforcement Fabricated: Reinforcement Fabricated is the date upon which Reinforcement for a concrete object has been fabricated.

DDD. Reinforce: Reinforce is the date upon which a concrete object has been reinforced.

EEE. Rebar Inspection: Rebar Inspection is the date upon which reinforcement for a concrete object has been inspected.

FFF. Pour: Pour is the date upon which a concrete object has been poured.

GGG. Concrete Inspection and Testing: Concrete Inspection and Testing is the date upon which Concrete Inspection and Testing has occurred.

HHH. Layout Verification: Layout Verification is the date upon which verification of the position of an object on the Project site has occurred.

III. Fabrication Started: Fabrication Started is the date upon which the Fabricator's fabrication process has begun. When this date has been recorded but the subsequent date has not been recorded, this will indicate that the fabrication process has begun and may be completed but the Fabricator's inspection has not been complete.

JJJ. Inspected by Fabricator: Inspected by Fabricator is the date upon which the Fabricator's own internal inspection process has been completed. When this date has been recorded but the subsequent date has not been recorded, this will indicate that an object has been fabricated, is ready for shipping by the Fabricator to the Coating facility but has not yet shipped.

KKK. Shipped to Coating: Shipped to Coating is the date upon which the Fabricator has shipped an object to the Coating facility.

LLL. Received by Coating: Received by Coating is the date upon which the Coating facility has received an object from the Fabricator.

MMM. Inspected by Coating: Inspected by Coating is the date upon which the Coating Facility has inspected an object. When this date has been recorded, this will also indicate that an object has been coated.

NNN. Shipped by Coating: Shipped by Coating is the date upon which the Coating Facility has shipped an object to the Project Site.

OOO. Received at Staging Area: Received at Staging area is the date upon which the Project has received an object and stored it in the Staging Area.

PPP. Received Onsite: Received Onsite is the date upon which an object has been moved from the Staging Area to the Project Site.

QQQ. Ready for Erection: Ready for Erection is the date upon which an object is ready to be erected by the Erector.

RRR. Erected: Erected is the date upon which an object has been erected.

SSS. Inspection: Inspection is the date upon which an object has been inspected by the required Inspector.

TTT. Final Sign-Off: Final Sign-Off is the date upon which Final Sign-Off has occurred.

UUU. Assembly: Assembly is the date upon which an elevator or escalator has been preassembled prior to installation.

VVV. Stringers Installed: Stringers Installed is the date upon which Stringers are installed.

WWW. Stadia Installed: Stadia Installed is the date upon which Stadia is installed.

XXX. Steps Installed: Steps Installed is the date upon which steps are installed.

YYY. Handrails Installed: Handrails Installed is the date upon which handrails are installed.

ZZZ. Seating QA/QC: Seating QA/QC is the date upon which all pre-seating installation quality checks have been performed.

AAAA. Ready for Seats: Ready for Seats is the date upon which all actions required prior to seating installation have been completed.

BBBB. Shipped to Warehouse: Shipped to Warehouse indicates the date that equipment is shipped from the Fabricator to the Warehouse for storage prior to delivery to the Project site.

CCCC. Shipped to Jobsite: Shipped to Jobsite indicates the date upon which equipment is shipped from the warehouse to the Project site.

DDDD. Infrastructure Connection: Infrastructure Connection is the date upon which equipment is connected to the infrastructure that is required for equipment to operate.

EEEE. Fabrication/Make-Up Started: Fabrication/Make-Up Started is the date upon which infrastructure elements are fabricated or assembled either in a shop or on the Project Site.

FFFF. As-Built Complete: As-Built Complete is the date upon which as-built documentation for all Site elements are complete.

END OF SECTION 013700

Building Information Model Coordination
Exhibit 1

ARTICLE 1 GENERAL PROVISIONS

1.1 This Exhibit establishes along with Section 013700 – Building Information Modeling (BIM) Project Requirements the protocols, expected levels of development, and authorized uses of Building Information Models on this Project and assigns specific responsibility for the development of each Model Element to a defined Level of Development at each Project phase. Where a provision in this Exhibit conflicts with a provision in the Agreement into which this Exhibit is incorporated, the provision in this Exhibit will prevail.

1.1.1 The parties agree to incorporate this Exhibit by reference into any other agreement for services or construction for the Project.

1.2 Definitions

1.2.1 Building Information Model. A Building Information Model(s) is a digital representation of the physical and functional characteristics of the Project and is referred to in this Exhibit as the "Model(s)," which term may be used herein to describe a Model Element, a single Model or multiple Models used in the aggregate. "Building Information Modeling" means the process and technology used to create the Model.

1.2.2 Level of Development. The Level(s) of Development (LOD) describes the level of completeness to which a Model Element is developed.

1.2.3 Model Element. A Model Element is a portion of the Building Information Model representing a component, system or assembly within a building or building site. For the purposes of this Exhibit, Model Elements are represented by the Construction Specifications Institute (CSI) UniFormat™ classification system in the Model Element Table at Section 3.3.

1.2.4 Model Element Author. The Model Element Author is the party responsible for developing the content of a specific Model Element to the LOD required for a particular phase of the Project. Model Element Authors are identified in the Model Element Table at Section 3.3.

1.2.5 Model User. The Model User refers to any individual or entity authorized to use the Model on the Project, such as for analysis, estimating or scheduling.

ARTICLE 2 LEVEL OF DEVELOPMENT

2.1 The following LOD descriptions identify the specific content requirements and associated authorized uses for each Model Element at five progressively detailed levels of completeness. Each subsequent LOD builds on the previous level and includes all the characteristics of previous levels. The parties shall utilize the five LOD described below in completing the Model Element Table at Section 3.3, which establishes the required LOD for each Model Element at each phase of the Project.

2.2 LOD 100

2.2.1 Model Content Requirements. Overall building massing indicative of area, height, volume, location, and orientation may be modeled in three dimensions or represented by other data.

2.2.2 Authorized Uses

2.2.2.1 Analysis. The Model may be analyzed based on volume, area and orientation by application of generalized performance criteria assigned to the representative Model Elements.

2.2.2.2 Cost Estimating. The Model may be used to develop a cost estimate based on current area, volume or similar conceptual estimating techniques (e.g., square feet of floor area, condominium unit, hospital bed, etc.).

2.2.2.3 Schedule. The Model may be used for project phasing and overall duration.

2.3 LOD 200

2.3.1 Model Content Requirements. Model Elements are modeled as generalized systems or assemblies with approximate quantities, size, shape, location, and orientation. Non-geometric information such as object name and quantities should be attached to Model Elements.

2.3.2 Authorized Uses

2.3.2.1 Analysis. The Model may be analyzed for performance of selected systems by application of generalized performance criteria assigned to the representative Model Elements.

23.3.2.2 Cost Estimating. The Model may be used to develop conceptual cost estimates based on the approximate data provided and conceptual estimating techniques (e.g., volume and quantity of elements or type of system selected).

2.3.2.3 Schedule. The Model may be used to show ordered, time-scaled appearance of major elements and systems.

2.4 LOD 300

2.4.1 Model Content Requirements. Model Elements are modeled as specific assemblies accurate in terms of quantity, size, shape, location, and orientation. Existing building elements are modeled as shown on building record drawings. Non-geometric information such as object description and object tags (door number, equipment number, etc) and quantities should be included with each object. Examples of the details required for systems modeled to LOD 300 include, but are not limited to:

PART 4 - Site Utilities
PART 5 - Masonry
PART 6 - Steel decking
PART 7 - Correct slopes for gravity piping for sanitary, or storm water systems.
PART 8 - Piping materials specifically called out on documents included with model element attributes (generic manufacturer for system components are acceptable).
PART 9 - Insulation around Pipe and Ducting.
PART 10 - Duct dampers included with the duct system.
PART 11 - Doors/Frames (hollow metal and storefront)
PART 12 - Owner Furnished Fixtures, Equipment, etc. generically modeled as space claims by the Model Element Author (MEA).

2.4.2 Authorized Uses

2.4.2.1 Construction. Suitable for the generation of traditional construction documents. Contractors may utilize this model for coordination purposes and creation of shop drawings.
2.4.2.2 Analysis. The Model may be analyzed for performance of selected systems by application of specific performance criteria assigned to the representative Model Elements.
2.4.2.3 Schedule. The Model may be used to show ordered, time-scaled appearance of detailed elements and systems.

2.5 LOD 400

2.5.1 Model Content Requirements. Model Elements are modeled as specific assemblies that are accurate in terms of size, shape, location, quantity, and orientation with complete fabrication, assembly, and detailing information. Non-geometric information such as manufacturer name, model and installation should also be included with each object in addition to the information added in LOD 300. Examples of the details, above any beyond LOD 300 details, required for systems modeled to LOD 400 include, but are not limited to:

PART 13 - Concrete
PART 14 - Concrete reinforcing steel
PART 15 - Anchor bolts
PART 16 - Structural Steel
PART 17 - Steel stairs, handrails
PART 18 - Floor/roof penetration steel
PART 19 - Significantly sized support hangers and stanchions for all systems.
PART 20 - Uni-Strut associated with system components if it is located in a tight overhead space (case by case basis).
PART 21 - Architectural millwork/casework.
PART 22 - Metal Panels and support steel.
PART 23 - Curtainwall System.
PART 24 - Steel Stud Framing including kickers and trusses at floor penetrations.
PART 25 - Valve locations.
PART 26 - Access panels (these should be modeled with the system they provide access to).
PART 27 - Conduit racks or other substantially wide / bundled electrical routing. (these can be generically modeled, i.e. extruded boxes, space claims)
PART 28 - Single conduit runs associated with any system (lighting, power, controls, etc) if needed to coordinate concrete coring.

PART 29 - Kitchen Equipment
PART 30 - MEP/FP & Low Voltage Equipment
PART 31 - MEP/FP & Low Voltage Systems
PART 32 - Pull box locations and any extra space claims for their access.

2.5.2 Authorized Uses

2.5.2.1 Construction. Model Elements are virtual representations of the proposed element and are suitable or construction.
2.5.2.2 Analysis. The Model may be analyzed for performance of approved selected systems based on specific Model Elements.
2.5.2.3 Schedule. The Model may be used to show ordered, time-scaled appearance of detailed specific elements and systems including construction means and methods.

2.6 LOD 500

2.6.1 Model Content Requirements. Model Elements are modeled as constructed assemblies actual and accurate in terms of size, shape, location, quantity, and orientation. Non-geometric information should be updated with actual installed items.

2.6.2 Authorized Uses

2.6.2.1 General Usage. The Model may be utilized for maintaining, altering, and adding to the Project, but only to the extent consistent with any licenses granted in the Agreement or in a separate licensing agreement.
2.6.2.2 Other Authorized Uses. The Model will be a tool for accessing as-built information for facility management and maintenance purposes.

ARTICLE 3 MODEL ELEMENTS

3.1 Reliance on Model Elements

3.1.1 The Model Element Table at Section 3.3 identifies (1) the LOD required for each Model Element at the end of each Project phase, and (2) the Model Element Author responsible for developing the Model Element to the LOD identified. Each Model Element Author's content is intended to be shared with subsequent Model Element Authors and Model Users throughout the course of the Project.

3.1.2 It is understood that while the content of a specific Model Element may include data that exceeds the required LOD identified in Section 3.3 for a particular phase, Model Users and subsequent Model Element Authors may rely on the accuracy and completeness of a Model Element consistent only with the content required for a LOD identified in Section 3.3.

3.1.3 Any use of, or reliance on, a Model Element inconsistent with the LOD indicated in Section 3.3 by subsequent Model Element Authors or Model Users shall be at their sole risk and without liability to the Model Element Author. To the fullest extent permitted by law, subsequent Model Element Authors and Model Users shall indemnify and defend the Model Element Author from and against all claims arising from or related to the subsequent Model Element Author's or Model User's modification to, or unauthorized use of, the Model Element Author's content.

3.2 Table Instructions

3.2.1 The table in Section 3.3 indicates the LOD to which each Model Element Author (MEA) is required to develop the content of the Model Element at the conclusion of each phase of the Project.

SECTION 014000 - 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. This 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 Architect, Owner, Contractor, or Authorities Having Jurisdiction (AHJ) are not limited by provisions of 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 Architect or Contractor.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

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

F. 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 (AHJ), to establish product performance and compliance with industry standards.

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

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

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

J. 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. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of Authorities Having Jurisdiction (AHJ).

1.4 REFERENCED STANDARDS

A. Conform to reference standard by date of issue current on date of Contract Documents.

B. Obtain copies of standards when required by Contract Documents.

C. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.6 SUBMITTALS

A. Qualification Data: 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.

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

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

C. Reports: Prepare and submit certified written reports that 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.

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.

1.7 QUALITY ASSURANCE

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

B. 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.

C. 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.

D. 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.

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 to those indicated for this Project in material, design, and extent.

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

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

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 548; and with additional qualifications specified in individual Sections; and where required by Authorities Having Jurisdiction (AHJ), 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. 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.

I. 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, mockups, and laboratory 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 Contractor, with copy to Architect. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow seven (7) days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 48.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by Authorities Having Jurisdiction (AHJ). Perform quality-control services required of Contractor by Authorities Having Jurisdiction (AHJ), whether specified or not.

1. 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.

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

C. 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 013300 "Submittal Procedures."

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 Architect, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect 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. Submit schedule within thirty (30) days of date established for commencement of the Work.

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

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by Authorities Having Jurisdiction (AHJ), as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Contractor, with copy to Architect and to Authorities Having Jurisdiction (AHJ).
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. Prepare a record of tests and inspections. Include the following:

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

3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Contractor'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.

1. Comply with the Contract Document requirements for cutting and patching in Section 017300 "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 014000

SECTION 015000 - 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.

1.3 REFERENCED STANDARDS

A. ADA - Americans with Disabilities Act.

1. ADAAG - Accessibility Guidelines for Buildings and Facilities. Adopted in 1991; continual revisions.

B. ANSI - American National Standards Institute.

1. ANSI A117.1: Accessible and Usable Buildings and Facilities.

C. ASTM - American Society for Testing and Materials International.

1. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E 136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C.

D. ICC - International Code Council, Inc.

1. ICC/ANSI A117.1: Accessible and Usable Buildings and Facilities.

E. NECA - National Electrical Contractors Association.

F. NEMA - National Electrical Manufacturers Association.

G. NFPA - National Fire Protection Association International.

1. NFPA 70: National Electrical Code.
2. NFPA 241: Safeguarding Construction, Alteration, and Demolition Operations.

H. UL - Underwriters Laboratories Inc.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's construction forces.
2. Occupants of Project.
3. Architect.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.

D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

1.5 SUBMITTALS

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

B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.

1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of the work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air filtration system discharge.
4. Other dust-control measures.
5. Waste management plan.

1.6 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.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 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 (51 mm), 0.148 inch (3.8 mm) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (41 mm) OD top rails.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils (0.25 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.

C. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

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

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

2.3 EQUIPMENT

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

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. 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. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

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

1. Install electric power service underground, unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations 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 offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect 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. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Site Enclosure Fence: Before construction operations begin, install chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.

1. Set fence posts in concrete bases.
2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

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

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.

2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 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.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

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

D. 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 the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. 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, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 015723 – TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Installation of Storm Water Pollution Prevention Plan (SWPPP) measures as per plans, specifications and the project SWPPP document for the purpose of preventing the discharge of pollutants from the construction site.

B. Compliance with local, state and federal regulations.

1.2 REFERENCES

A. California Storm Water Best Management Practice Handbook for Construction Activity (BMP Handbook)

B. Construction General Permit (CGP) Order No. 2009-009-DWQ

1.3 SUBMITTAL REQUIREMENTS

A. Product Data: Provide product catalog cut sheets of all temporary and permanent equipment and specialty items that will be provided to comply with the SWPPP, including items necessary for storage, disposal and recycling.

B. Shop Drawings: Provide site plan indicating construction staging, storage, refuse areas and vehicular routing and parking areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials of a class, grade and type needed to meet the performance described in the BMP Handbook and project SWPPP document.

PART 3 - EXECUTION

3.1 QUALIFIED SWPPP DEVELOPER (QSD)

A. The owner shall designate a Qualified SWPPP Developer (QSD) having registrations, certifications and appropriate experience as defined by the State of California Construction General Permit (CGP) Order No. 2009-009-DWQ to perform the following:

1. Prepare, certify and amend as required the project SWPPP document.
2. Assist the owner in obtaining permit coverage prior to the commencement of construction activity through filing of Permit Registration Document (PRDs) on the Storm Water Multiple Application and Report Tracking System (SMARTS).
3. Assist the owner in filing the Notice of Termination (NOT) when construction is complete and final stabilization has been reached.

3.2 QUALIFIED SWPPP PRACTITIONER (QSP)

A. The owner shall designate a Qualified SWPPP Practitioner (QSP) having registrations, certifications and appropriate experience as defined by the State of California Construction General Permit (CGP) Order No. 2009-009-DWQ to perform the following:

1. Conduct storm water and non-storm water visual inspections of Best Management Practices (BMPs) and prepare documentation as prescribed by the CGP according to the risk level and project type.
2. Identifying BMP failures or shortcomings and provide an action plan to correct the deficiencies.
3. Conduct discharge monitoring as prescribed by the CGP for pH, turbidity, and non-visible pollutant monitoring, according to the project risk level and project type.
4. Develop a Rain Event Action Plan (REAP) for Risk Level 2 and 3 projects for qualifying rain events.
5. Conduct pre-storm event visual inspections for qualifying rain events.
6. Implement a Construction Site Monitoring Program (CSMP).
7. Track weather forecasts from the National Oceanic and Atmospheric Administration (NOAA) in accordance with Permit requirements.
8. Complete applicable monitoring, sampling, and inspection logs, forms and documents for filing to the Storm Water Multiple Application and Report Tracking System (SMARTS).
9. Report Numeric Action Level (NAL) exceedances to SMARTS for Risk Level 2 and 3 projects.
10. Provide assistance to the owner with annual reporting requirements.

3.3 PERFORMANCE BY CONTRACTOR

A. General

1. Keep the original SWPPP document in a readily accessible location at the construction site from the commencement of construction activity until submission of the Notice of Termination (NOT) for storm water discharges associated with construction activity. Contractors with day to day operation control over SWPPP implementation shall have the original SWPPP document available at a central location, on-site, for the use of all operators and those identified as having responsibility under the SWPPP.
2. Review the SWPPP. Ensure that all key personnel understand the requirements of the SWPPP.
3. Provide to the QSD, names of all key subcontractors involved in earthwork/land disturbing activities.

B. Good Site Management "Housekeeping"

1. For projects designated as Risk Level 1 and above, implement good site management (i.e., "housekeeping") measures for construction materials that could potentially be a threat to water quality if discharged. At a minimum, the contractor shall implement the following good housekeeping measures:

    a. Conduct an inventory of the products used and/or expected to be used and the end products that are produced and/or expected to be produced. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).
    b. Cover and berm loose stockpiled construction materials that are not actively being used (i.e. soil, spoils, aggregate, fly-ash, stucco, hydrated lime, etc.).
    c. Store chemicals in watertight containers (with appropriate secondary containment to prevent any spillage or leakage) or in a storage shed (completely enclosed).
    d. Minimize exposure of construction materials to precipitation. This does not include materials and equipment that are designed to be outdoors and exposed to environmental conditions (i.e. poles, equipment pads, cabinets, conductors, insulators, bricks, etc.).
    e. Implement Best Management Practices to prevent the off-site tracking of loose construction and landscape materials.

2. For projects designated as Risk Level 1 and above, implement good housekeeping measures for waste management, which, at a minimum, shall consist of the following:

    a. Prevent disposal of any rinse or wash waters or materials on impervious or pervious site surfaces or into the storm drain system.
    b. Ensure the containment of sanitation facilities (e.g., portable toilets) to prevent discharges of pollutants to the storm water drainage system or receiving water.
    c. Clean or replace sanitation facilities and inspect them regularly for leaks and spills.
    d. Cover waste disposal containers at the end of every business day and during a rain event.
    e. Prevent discharges from waste disposal containers to the storm water drainage system or receiving water.
    f. Contain and securely protect stockpiled waste material from wind and rain at all times unless actively being used.
    g. Implement procedures that effectively address hazardous and non-hazardous spills.

        1) Equipment and materials for cleanup of spills shall be available on site. Spills and leaks shall be cleaned up immediately and disposed of properly.
        2) Appropriate spill response personnel shall be assigned and trained.
        3) Ensure the containment of concrete washout areas and other washout areas that may contain additional pollutants so there is no discharge into the underlying soil and onto the surrounding areas.

3. For projects designated as Risk Level 1 and above, implement good housekeeping for vehicle storage and maintenance, which, at a minimum, shall consist of the following:

    a. Prevent oil, grease, or fuel to leak in to the ground, storm drains or surface waters.
    b. Place all equipment or vehicles, which are to be fueled, maintained and stored in a designated area fitted with appropriate Best Management Practices.
    c. Clean leaks immediately and dispose of leaked materials properly.

4. For projects designated as Risk Level 1 and above, implement good housekeeping for landscape materials, which, at a minimum, shall consist of the following:

    a. Contain stockpiled materials such as mulches and topsoil when they are not actively being used.
    b. Contain all fertilizers and other landscape materials when they are not actively being used.
    c. Discontinue the application of any erodible landscape material within two days before a forecasted rain event or during periods of precipitation.
    d. Apply erodible landscape material at quantities and application rates according to manufacture recommendations or based on written specifications by knowledgeable and experienced field personnel.
    e. Stack erodible landscape material on pallets and cover or store such materials when not being used or applied.

5. Maintain an inventory of materials in association with the Material Safety Data Sheet (MSDS) per OSHA requirements. Provide to QSP upon request.
6. For projects designated as Risk Level 1 and above, implement good housekeeping measures on the construction site to control the air deposition of site materials and from site operations. Such particulates can include, but are not limited to, sediment, nutrients, trash, metals, bacteria, oil and grease and organics.
7. For projects designated as Risk Level 2 or 3, implement the Rain Event Action Plan (REAP) as directed by the QSP.
8. For projects designated as Risk Level 1 and above, begin implementing repairs or changes to BMPs within 72 hours of identification as directed by the QSP and complete the changes as soon as possible.

C. Non-Storm Water Management

1. For projects designated as Risk Level 1 and above, implement measures to control all non-storm water discharges during construction.
2. For projects designated as Risk Level 1 and above, wash vehicles in such a manner as to prevent non-storm water discharges.
3. For projects designated as Risk Level 1 and above, clean streets in such a manner as to prevent unauthorized non-storm water discharges.

D. Erosion Control

1. For projects designated as Risk Level 1 and above, implement effective wind erosion control.
2. For projects designated as Risk Level 1 and above, provide effective soil cover for inactive areas and all finished slopes, open space, utility backfill, and completed lots.
3. For projects designated as Risk Level 1 and above, limit the use of plastic materials when more sustainable, environmentally friendly alternatives exist. Where plastic materials are deemed necessary, the discharger shall consider the use of plastic materials resistant to solar degradation.

E. Sediment Controls

1. For projects designated as Risk Level 1 and above, establish and maintain effective perimeter controls and stabilize all construction entrances and exits to sufficiently control erosion and sediment discharges from the site.

2. For projects designated as Risk Level 1 and above, on sites where sediment basins are to be used, at minimum, install and maintain sediment basins according to the method provided in CASQA's Construction BMP Guidance Handbook.
3. For projects designated as Risk Level 2 or 3, implement appropriate erosion control Best Management Practices (runoff control and soil stabilization) in conjunction with sediment control Best Management Practices for areas under active construction. Active areas of construction are areas undergoing land surface disturbances.
4. For projects designated as Risk Level 2 or 3, install linear sediment controls along the toe of the slope, face of the slope, and at the grade breaks of exposed slopes to comply with sheet flow lengths in accordance with Table 1.

Table 1 – Critical Slope/Sheet Flow Length Combinations

Slope Percentage	Sheet Flow Length Not to Exceed
0 - 25 percent	20 feet
25 - 50 percent	15 feet
Over 50 percent	10 feet

F. For projects designated as Risk Level 2 or 3, ensure that construction activity traffic to and from the project is limited to entrances and exits that employ effective controls to prevent offsite tracking of sediment.

1. For projects designated as Risk Level 2 or 3, ensure that all storm drain inlets and perimeter controls, runoff control Best Management Practices, and pollutant controls at entrances and exits (e.g. tire washoff locations) are maintained and protected from activities that reduce their effectiveness.
2. For projects designated as Risk Level 2 or 3, inspect on a daily basis all immediate access roads daily. At a minimum daily (when necessary) and prior to any rain event, remove any sediment or other construction activity related materials that are deposited on the roads (by vacuuming or sweeping).

G. Run-on and Run-off Controls

1. For projects designated as Risk Level 1 and above, effectively manage all run-on, all runoff within the site and all runoff that discharges off the site. Run-on from offsite shall be directed away from all disturbed areas or shall collectively be in compliance with the effluent limitations in this General Permit.

END OF SECTION 015723

SECTION 016000 - PRODUCT 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. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Completed List: Submit in sufficient time to allow review and timely procurement.
3. Architect's Action: Architect will respond in writing to Contractor. Architect's response will include a list of unacceptable product selections Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three (3) 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 Architect's Substitution Request Form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications 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. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to Authorities Having Jurisdiction (AHJ).
    i. 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 lack of availability or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.
    k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    l. 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. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

    a. Form of Acceptance: Change Order.

b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three (3) 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. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 012500 "Submittal Procedures."
b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 012500 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
2. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
3. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
4. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
5. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
6. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers. Other named manufacturers listed are approved as sources provided the product proposed conforms to design criteria established by the product identified under the "Basis-of-Design".
7. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
8. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within thirty (30) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of Authorities Having Jurisdiction (AHJ).
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. 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.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - 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. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

1.3 QUALITY ASSURANCE

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

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. 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 separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Mechanical systems piping and ducts.
f. Control systems.
g. Communication systems.
h. Fire-detection and -alarm systems.
i. Conveying systems.
j. Electrical wiring systems.
k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 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 Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: 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; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: 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.

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

    a. Description of the Work.
    b. List of detrimental conditions, including substrates.
    c. List of unacceptable installation tolerances.
    d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. 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 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 (AHJ).

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 before proceeding.

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 Architect promptly.

B. General: Engage a Professional Surveyor to lay out the Work using accepted surveying practices.

1. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
2. Inform installers of lines and levels to which they must comply.
3. Check the location, level and plumb, of every major element as the Work progresses.
4. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
5. 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 invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. 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 Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will 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 Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect 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 (2) 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.

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.
4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

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

F. 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.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work. Coordinate backing requirements with other trades.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building 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.

H. 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.

I. 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 011000 "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.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of waste materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. 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.

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

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

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. 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.

I. 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.

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

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: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 014000 "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.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 – 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.

B. Specification Section 018113 "Sustainable Design Requirements".

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for a required Site Waste Management Program This program shall include the following:

1. Salvaging, recycling, and disposing of nonhazardous construction waste.

B. Performance Goals:

1. General: Develop waste management plan in accordance with ASTM E 1609 and as specified herein that results in end-of-Project rates for salvage/recycling of 50 percent by weight of total waste generated by the Work.
2. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous construction waste as possible including the following materials:

a. Construction Waste: Track all waste hauling by weight or by volume.

1) Site-clearing waste.
2) Masonry and CMU.
3) Lumber.
4) Wood sheet materials.
5) Wood trim.
6) Metals.
7) Roofing.
8) Insulation.
9) Carpet and pad.
10) Gypsum board.
11) Piping.
12) Electrical conduit.
13) Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

a) Paper.
b) Cardboard.
c) Boxes.
d) Plastic sheet and film.
e) Polystyrene packaging.
f) Wood crates.

g) Plastic pails.

1.3 REFERENCED STANDARDS

A. ASTM - American Society for Testing and Materials International.

1. ASTM E 1609: Development and Implementation of a Pollution Prevention Program.
2. ASTM E 2114: Standard Terminology for Sustainability Relative to the Performance of Buildings.

B. HFH - Habitat for Humanity International.

1.4 DEFINITIONS

A. Definitions pertaining to sustainable development: As defined in ASTM E 2114.

1.5 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 30 days of date established for commencement of the Work.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for construction 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.

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

D. Approval of Contractor's plan shall not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

E. Submit final waste report showing facilities and combined diversion rates exceeding 75% diversion from landfills.

1.6 QUALITY ASSURANCE

A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss site waste management plan including responsibilities of Waste Management Coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Include separate sections in plan construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

D. Identify waste haulers and/or facilities and include company name and address in waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SITE WASTE MANAGEMENT

A. Develop and implement a waste management program in accordance with ASTM E 1609 and as specified herein.

3.2 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Architect, Owner, and Construction Manager. 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 Section 015000 "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Waste Management Coordinator: Appoint a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

3.3 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycling/Reuse on project site. Contractor and subcontractors are both required to separate recyclable materials into bins and to arrange for delivery of recyclable materials to recycling depot. Clearly label all recycling containers and list acceptable and unacceptable materials.

B. Recycle paper and beverage containers used by on-site workers.

C. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following: Recycling/Reuse off project site. The following is a partial list for Contractor's information only. For more information, contact the State Department of Environmental Quality and the local Integrated Solid Waste Management Office.

1. HFH, a non-profit housing organization that rehabilitates and builds housing for low-income families. Sites requiring donated materials vary. Contact the national hotline at (800) HABITAT.

D. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

3.4 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. Site-Clearing Wastes: Chip brush, branches, and trees.

1. Comply with requirements for use of chipped organic waste as organic mulch.

C. 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.

a. Comply with requirements for use of clean sawdust as organic mulch.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

    a. Comply with requirements for use of clean ground gypsum board as inorganic soil amendment.

3.5 DISPOSAL OF WASTE

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

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - 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. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect 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 Architect, 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.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will 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.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three (3) copies 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. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

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

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (216 by 279 mm) 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.

D. 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.

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

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

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not dispose of debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 018113 – SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general requirements and procedures for achieving LEED for New Construction (LEED NC) at the GOLD level and for meeting the mandatory requirements of the California Green Building Code (CalGreen).

1.2 OBJECTIVES

A. To achieve LEED NC GOLD certification and meet the mandatory requirements of CalGreen. During the construction phase of this project, the contractor shall implement the following procedures singly or in combination:

1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce and employ recycled materials. To help purchasers incorporate environmental considerations into purchasing decisions, it is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:

    a. Include environmental considerations as part of the normal purchasing process.
    b. Emphasize pollution prevention early in the purchasing process.
    c. Examine multiple environmental attributes throughout a product's or service's life cycle.
    d. Compare relevant environmental impacts when selecting products and services.
    e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.

2. Control sources for potential IAQ pollutants by controlled selection of materials and processes used in project construction in order to attain superior IAQ.
3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support these objectives in developing means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.

1.3 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. 01 91 00 General Commissioning Requirements

1.4 DEFINITIONS

A. Agrifiber Products: Composite panel products derived from agricultural fiber

B. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products has been tracked through its extraction and fabrication to ensure that is was obtained from forests certified by a specified certification program

C. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder

D. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair and demolition operations. A construction waste management plan is to be provided by the Contractor as defined in Section 017419.

E. LEED: The Leadership in Energy & Environmental Design green building rating systems developed and adopted by the U.S. Green Building Council (USGBC). The systems certify levels of environmental achievement based on a point and credit scoring system.

F. LEED NC: The Leadership in Energy & Environmental Design green building rating system developed and adopted by the USGBC for new construction and major renovations of buildings

G. Light Pollution: Light that extends beyond its source such that the additional light is wasted in an unwanted area or in an area where it inhibits view of the night sky.

H. Recycled Content Materials: Products that contain pre-consumer or post-consumer materials

I. Post-Consumer Recycled Content: The percentage by weight of constituent materials that have been recovered or otherwise diverted from the solid-waste stream after consumer use

J. Pre-Consumer Recycled Content: Materials that have been recovered or otherwise diverted from the solid-waste stream during the manufacturing process. Pre-consumer content must be material that would not have otherwise entered the waste stream as per Section 5 of the FTC Act, Part 260 “Guidelines for the Use of Environmental Marketing Claims”: www.ftc.gov/bcp/grnrule/guides980427

K. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 500 miles (400 km) from the Project site

L. Sealant: Any material that fills and seals gaps between other materials

M. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

1.5 SUBMITTALS

A. General: Additional Sustainable Design submittal requirements are included in other sections of the Specifications.

B. Sustainable Design Submittals:

1. Alternative Transportation: Provide manufacturer's cut sheets for all bike racks installed on site, including the total number of bicycle storage slots provided. Also, provide manufacturer's cut sheets for any alternative-fuel refueling stations installed on site, including fueling capacity information for an 8-hour period.
2. Heat Island Effect: Roofing Materials: Submittals for roofing materials must include manufacturer's cut sheets or product data highlighting the Solar Reflectance Index (SRI) of the material.
3. Exterior Lighting Fixtures: Submittals for non-emergency exterior lighting must include cut sheets with photometric data and Backlight/Uplight/Glare (BUG) Ratings.
4. Irrigation Systems: Provide manufacturer's cut sheets for irrigation system controllers.
5. Water Conserving Fixtures: Submittals must include manufacturer's cut sheets for all water-consuming plumbing fixtures and fittings (toilets, urinals, faucets, showerheads, etc.) highlighting maximum flow rates and/or flush rates. Include cut sheets for any automatic faucet-control devices.
6. Process Water Use: Provide manufacturer's cut sheets for all water-consuming commercial equipment (clothes washers, dishwashers, ice machines, etc.), highlighting water consumption performance. Include manufacturer's cut sheets or product data for any cooling towers, highlighting water consumption estimates, water use reduction measures, and corrosion inhibitors.
7. Elimination of CFCs AND HCFCs: Provide manufacturer's cut sheets for all cooling equipment with manufacturer's product data, highlighting refrigerants; provide manufacturer's cut sheets for all fire-suppression equipment, highlighting fire-suppression agents; provide manufacturer's cut-sheets for all polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation, highlighting the blowing agent(s).
8. On-Site Renewable Energy Systems: Provide cut sheets and manufacturer's product data for all on-site renewable energy generating components and equipment, including documentation of output capacity.
9. Recycled Content: Submittals for all materials with recycled content (excluding MEP systems equipment and components) must include the following documentation:

    a. Cost of each material or product, excluding cost of labor and equipment for installation
    b. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the percentage of post-consumer and pre-consumer recycled content (by weight) of each material or product
    c. An electronic spreadsheet that tabulates the Project's total materials cost and combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value) expressed as a percentage of total materials cost. This spreadsheet shall be submitted every month with the Contractor's Certificate and Application for Payment. It should indicate, on an ongoing basis, line items for each material, including cost, pre-consumer recycled content and post-consumer recycled content OR combined recycled content value.

10. Regional Materials: Submittals for all products or materials expected to contribute to the regional calculation (excluding MEP systems equipment and components) must include the following documentation:

    a. Cost of each material or product, excluding cost of labor and equipment for installation
    b. Location of product manufacture and distance from point of manufacture to the Project Site

c. Location of point of extraction, harvest, or recovery for each raw material in each product and distance from the point of extraction, harvest, or recovery to the Project Site
d. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of manufacture for each regional material
e. Manufacturer's product data, product literature, or a letter from the manufacturer verifying the location and distance from the Project Site to the point of extraction, harvest, or recovery for each regional material or product, including, at a minimum, gravel and fill, planting materials, concrete, masonry, and GWB
f. An electronic spreadsheet that tabulates the Project's total materials cost and regional materials value, expressed as a percentage of total materials cost. This spreadsheet shall be submitted every month with the Contractor's Certificate and Application for Payment. It should indicate on an ongoing basis, line items for each material, including cost, location of manufacture, distance from manufacturing plant to the Project Site, location of raw material extraction, and distance from extraction point to the Project Site.

11. Interior Adhesives and Sealants: Submittals for all field-applied adhesives and sealants, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.

    a. Provide manufacturers' documentation verifying all adhesives used to apply laminates, whether shop-applied or field-applied, contain no urea-formaldehyde.
    b. The contractor shall create a spreadsheet for the city building inspector showing all adhesives and sealants used on the project, their VOC contents and acceptable limit based on those given in section 2.1G.

12. Interior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on indoor air, must include manufacturer's MSDSs or other Product Data highlighting VOC content.
13. Exterior Paints and Coatings: Submittals for all field-applied paints and coatings, which have a potential impact on ambient air quality, must include manufacturer's MSDSs or other manufacturer's Product Data highlighting VOC content.
14. Paints and Coatings: The contractor shall create a spreadsheet for the city building inspector showing all paints and coatings used on the project, their VOC contents and acceptable limit based on those given in section 2.1H.
15. Floorcoverings:

    a. Carpet Systems: Submittals for all carpet must include the following: Manufacturer's product data verifying that all carpet systems meet or exceed the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
    b. Resilient Flooring: Submittals for all resilient floorcovering must include manufacturer's product data verifying certification under either the Greenguard for Children & Schools or FloorScore indoor emissions testing program.

16. Composite Wood and Agrifiber Binders: Submittals for all composite wood and agrifiber products (including but not limited to particleboard, wheatboard, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products) must include manufacturer's product data verifying that these products contain no urea-formaldehyde resins.

17. Entryway Systems: Provide manufacturer's cut sheets for all walk-off systems installed to capture particulates, including permanently installed grates, grilles, slotted systems, direct glue-down walk-off mats, and non-permanent roll-out mats.
18. Air Filtration: Provide manufacturer's cut sheets and product data highlighting the following:

    a. Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs)
    b. Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction

19. Lighting Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all lighting controls systems components.
20. Thermal Comfort Controls: Provide manufacturer's cut sheets and shop drawing documentation highlighting all thermal comfort-control systems components.

C. Project Materials Cost Data: Provide a spreadsheet in an electronic file indicating the total cost for the Project and the total cost of building materials used for the Project, as follows:

1. Not more than 60 days after the Preconstruction Meeting, the General Contractor shall provide a preliminary schedule of materials costs for all materials used for the Project organized by specification section. Exclude labor costs and all mechanical, electrical, and plumbing (MEP) systems materials and labor costs. Include the following:

    a. Identify each recycled-content material, its post-consumer and pre-consumer recycled content as a percentage the product's weight, its cost, its combined recycled content value (defined as the sum of the post-consumer recycled content value plus one-half of the pre-consumer recycled content value), and the total combined recycled content value for all materials as a percentage of total materials costs.
    b. Identify each regional material, its cost, its manufacturing location, the distance of this location from the Project site, the source location for each raw material component of the material, the distance of these extraction locations from the Project site, and the total value of regional materials as a percentage of total materials costs.

2. Provide final versions of the above spreadsheets to the Owner and Architect not more than 14 days after Substantial Completion.

D. Construction Waste Management: See Section 017419 "Construction Waste Management" for submittal requirements.

E. Construction Indoor Air Quality (IAQ) Management: Submittals must include the following:

1. Not more than 30 days after the Preconstruction Meeting, prepare and submit an electronic copy of the draft Construction IAQ Management Plan in an electronic file including, but not limited to, descriptions of the following:

a. Construction procedures for meeting or exceeding the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling
b. Construction procedures for protecting absorptive materials stored on-site or installed from moisture damage
c. Schedule of submission to Architect of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials
d. Construction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille
e. Construction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit

2. Not more than 30 days following receipt of the approved draft CIAQMP, submit an electronic copy of the approved CIAQMP in an electronic file, along with the following:

a. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for all filtration media to be installed at return air grilles during construction if permanently installed AHUs are used during construction.
b. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media in all air handling units (AHUs).

3. Not more than 14 days after Substantial Completion provide the following:

a. Documentation verifying required replacement of air filtration media in all air handling units (AHUs) after the completion of construction and prior to occupancy and, if applicable, required installation of filtration during construction.
b. A minimum of 18 Construction photographs: Six photographs taken on three different occasions during construction of the SMACNA approaches employed, along with a brief description of each approach, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

F. Commissioning: See Section 019100 "Commissioning Requirements" for submittal requirements.

G. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports for the following:

1. Construction Waste Management: Waste reduction progress reports and logs complying with the requirements of Section 017419 "Construction Waste Management."
2. Construction IAQ Management: See details below under Section 3.2 Construction Indoor Air Quality Management for Construction IAQ management progress report requirements.

1.6 QUALITY ASSURANCE

A. General: Perform the work of this Section as a supplement and in accordance with applicable requirements of Division 1 "Contractor Quality Control Program."

B. Preconstruction Meeting: After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner, Architect, and all Subcontractors to discuss the Construction Waste Management Plan, the required Construction Indoor Air Quality (IAQ) Management Plan and all other Sustainable Design Requirements. The purpose of this meeting is to develop a mutual understanding of the Project's Sustainable Design Requirements and coordination of the Contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.

C. Construction Job Conferences: The status of compliance with the Sustainable Design Requirements of these specifications will be an agenda item at all regular job meetings conducted during the course of work at the site.

PART 2 - PRODUCTS

2.1 PRODUCT ENVIRONMENTAL REQUIREMENTS

A. Roofing Materials: All roofing systems must comply with the following requirements:

1. Low-Sloped roofing less than or equal to 2:12 slope must have an SRI of at least 78.
2. Steep-Sloped roofing greater than 2:12 slope must have an SRI of at least 29.

B. Exterior Lighting Fixtures:

1. All exterior luminaires must emit 0% of the total initial designed fixture lumens at an angle above 90° from nadir and/or meet the requirements of the Dark Sky certification program.
2. Exterior lighting cannot exceed 80% of the lighting power densities defined by ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.
3. Exterior lighting fixtures shall meet the Maximum Allowable Backlight, Uplight and Glare Ratings for Lighting Zone 3 in Table 5.106.8 in the 2010 California Green Building Standards Code with July 1, 2012 Supplement.

C. Water-Conserving Fixtures: Flow and flush rates shall not exceed the following:

1. Hotel Room Toilets: 1.28 gallons per flush and meet the US EPA WaterSense Tank-Type High-Efficiency Toilet Specification
2. First Floor Flushometer Toilets: 1.00 gallons per flush and meet the requirements of ASME A 112.19.2 / CSA B45.1.
3. Urinals: no more than 0.125 gallons per flush or use meet the requirements of ASME A 112.19.2 / CSA B45.1.
4. Lavatory Faucets: 0.5 gpm with automatic faucet controls and meet the requirements of ASME A 112.18.1 / CSA B125.1.
5. Kitchen Sink Lavatories: 1.8 gpm.
6. Showerheads: 2.0 gpm and meet the requirements of ASME A 112.18.1 / CSA B125.1.

D. Elimination of CFCs AND HCFCs:

1. Ozone Protection: Base building cooling equipment shall contain no refrigerants other than or HFC 410a.
2. Fire suppression systems may not contain ozone-depleting substances.

E. Recycled Content of Materials:

1. Provide building materials with recycled content such that post-consumer recycled content value plus half the pre-consumer recycled content value constitutes a minimum of 15% of the cost of materials used for the Project, exclusive of all MEP equipment, labor, and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials with recycled content.

    a. The post-consumer recycled content value of a material shall be determined by dividing the weight of post-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
    b. The pre-consumer recycled content value of a material shall be determined by dividing the weight of pre-consumer recycled content by the total weight of the material and multiplying by the cost of the material.
    c. Do not include mechanical and electrical components in the calculations.
    d. Do not include labor and delivery costs in the calculations.
    e. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).
    f. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value.

F. As a guideline, the contractor should strive to use materials in the following list with the minimum recycled content indicated:

Category	**Minimum Recycled Content**
Compost/mulch	100% post-consumer
Asphaltic Concrete Paving	25% post-consumer
Cast-in-Place Concrete	6% pre-consumer
CMU: Gray Block	20% pre-consumer
Steel Reinforcing Bars	90% combined
Structural Steel Shapes	90% combined
Steel Joists	75% combined
Steel Deck	75% combined
Steel Fabrications	60% combined
Steel Studs	30% combined
Steel Roofing	30% post-consumer
Aluminum Fabrications	35% combined
Rigid Insulation	20% pre-consumer
Batt insulation	30% combined
Cellulose Insulation	90% combined
Rock Wool Insulation	75% pre-consumer
Fireproofing	20% combined
Steel Doors and Frames	35% combined
Gypsum Wallboard	100% combined
Carpet	40% combined
Ceramic Tile Flooring	60% combined
Rubber Flooring and Base	60% combined
Acoustical Ceiling Tile (ACT)	40% post-consumer
ACT Suspension System	90% post-consumer
Toilet Partitions	60% post-consumer

G. Regional Materials: Provide a minimum of 10 percent of building materials (by cost) that are manufactured and extracted/harvested within a 500 mile radius of the project site, exclusive of labor and delivery costs. The Contractor shall make all attempts to maximize the procurement of materials within this specified 500 mile radius.

1. The contractor should attempt to procure the following materials from regional sources:

a. Aggregate
b. Concrete
c. Gypsum Board
d. Steel

H. Adhesives and Sealants:

1. All adhesives and sealants, regardless of where they are used, must comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24):

a. Concrete Curing Compound: 60 g/L
b. Concrete Sealer: 10 g/L
c. Concrete Form Release Agents: 0g/L
d. Garage Deck Sealer: 50g/L
e. Wood Glues: 20 g/L
f. Millwork and Casework Adhesives: 20g/L
g. Metal to Metal Adhesives: 30 g/L
h. Adhesives for Porous Materials (Except Wood): 50 g/L
i. Subfloor Adhesives: 50 g/L
j. Plastic Foam Adhesives: 50 g/L
k. Carpet Adhesives: 50 g/L
l. Carpet Pad Adhesives: 50 g/L
m. Carpet Seam Sealer: 50g/L
n. VCT and Sheet Vinyl Adhesives: 50 g/L
o. Cove Base Adhesives: 50 g/L
p. Rubber Floor Adhesives: 60 g/L
q. Wood Flooring Adhesives: 100 g/L
r. Ceramic Tile Adhesives: 65 g/L
s. Gypsum Board and Panel Adhesives: 50 g/L
t. Gypsum Drywall Joint Compound: 20 g/L
u. Portland Cement Plaster: 20 g/L
v. Multipurpose Construction Adhesives: 70 g/L
w. Cast Resin Countertop Silicone Sealant: 20g/L
x. Plastic Laminate Adhesives: 20 g/L
y. General Contact Adhesive: 80 g/L
z. Structural Glazing Adhesives and Compounds: 100 g/L
aa. Silicone Sealant: 50 g/L
bb. Pipe Thread Sealant: 50 g/L
cc. Duct Sealant: 10 g/L
dd. Plastic Cement Welding Compounds: 250 g/L
ee. ABS Welding Compounds: 400 g/L
ff. CPVC Welding Compounds: 270 g/L
gg. PVC Welding Compounds: 150 g/L
hh. Adhesive Primer for Plastic: 250 g/L
ii. Architectural Sealants: 250 g/L
jj. Single-Ply Roofing Membrane Adhesives: 250 g/L

2. Interior sealants shall not contain: mercury, butyl rubber, neoprene, SBR (styrene butadiene rubber), or nitrile.
3. Sealants and glazing compounds formulated with aromatic solvents (organic solvent with a benzene ring in its molecular structure) fibrous talc or asbestos, formaldehyde, halo-genated solvents, mercury, lead, cadmium, hexavalent chromium, or their components shall not be used.
4. Adhesives used to apply laminates, whether shop-applied or field-applied, shall contain no urea-formaldehyde.

I. Paints and Coatings:

1. Interior Paints and Coatings: For interior field-applied applications, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the chemical restrictions (Restricted Components listed below) of Green Seal Standard GS-11, Paints, First Edition, May 20, 1993; Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997; and South Coast Air Quality Management District Rule 1113, Architectural Coatings, rules in effect on January 1, 2004, as follows:

    a. Flat Paints and Coatings: Not more than 50 grams of VOC per liter of coating less water and exempt compounds, including pigments
    b. Non-Flat Paints and Coatings Except High Gloss: Not more than 50 grams of VOC per liter of coating less water and exempt compounds, including pigments.
    c. High Gloss Paints and Coatings: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments. High Gloss Coatings are coatings that register a gloss of 70 or above on a 60-degree meter according to ASTM Test Method D 523 as specified in paragraph (e)(6).
    d. Water-Based Polychromatic Finish Coatings: Not more than 150 g/L (150 g/L for primer and flat polychromatic paint)
    e. Anti-Corrosive Coatings: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
    f. Sanding Sealers: Not more than 50 grams of VOC per liter of coating less water and exempt compounds
    g. Waterproofing Sealers: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
    h. Concrete Slab Sealers: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
    i. Polyurethanes: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
    j. Stains: Not more than 250 grams of VOC per liter of coating less water and exempt compounds

2. Interior paints shall not contain antimicrobial additives (such as fungicides and biocides).
3. Exterior Paints and Coatings: For exterior applications, use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the chemical restrictions (Restricted Components listed below) of Green Seal's Standard GS-11:

    a. Flat Paints and Coatings: Not more than 50 grams of VOC per liter of coating less water and exempt compounds, including pigments
    b. Non-Flat Paints and Coatings: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments

c. High Gloss Paints and Coatings: Not more than 150 grams of VOC per liter of coating less water and exempt compounds, including pigments. High Gloss Coatings are coatings that register a gloss of 70 or above on a 60-degree meter according to ASTM Test Method D 523 as specified in paragraph (e)(6)
d. Anti-Corrosive Coatings: Not more than 100 grams of VOC per liter of coating less water and exempt compounds
e. Varnishes and Sanding Sealers: Not more than 275 grams of VOC per liter of coating less water and exempt compounds
f. Stains: Not more than 250 grams of VOC per liter of coating less water and exempt compounds

4. Aromatic Compounds: Paints and coatings shall not contain more than 1% (by weight) total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
5. Restricted Components: Paints and coatings shall not contain any of the following:

a. Acrolein
b. Acrylonitrile
c. Analine dyes
d. Antimony
e. Benzene
f. Butyl benzyl phthalate
g. Cadmium
h. Di (2-ethylhexyl) phthalate
i. Di-n-butyl phthalate
j. Di-n-octyl phthalate
k. 1,2-dichlorobenzene
l. Diethyl phthalate
m. Dimethyl phthalate
n. Ethylbenzene
o. Formaldehyde
p. Hexavalent chromium
q. Isophorone
r. Lead
s. Mercury
t. Methyl ethyl ketone
u. Methyl isobutyl ketone
v. Methylene chloride
w. Naphthalene
x. Toluene (methylbenzene)
y. 1,1,1-trichloroethane
z. Vinyl chloride
aa. Xylene

6. Coordinate with paint manufacturers for implementing a “take-back program” for all unused paint. Set aside scrap and unused paint to be returned to the manufacturer for recycling into new product. Close and seal all partially used containers of paint to maintain quality as necessary for reuse.

J. Floorcoverings:

1. All carpet systems, including adhesives, must meet or exceed the Carpet and Rug Institute Green Label Plus Indoor Air Quality Test Program.
2. Carpet cushion shall not contain brominated flame retardants.

3. Carpet tile applications shall be self-adhering.
4. All resilient floorcovering must be certified under the Greenguard or FloorScore indoor emissions testing programs.

K. Composite Wood and Agrifiber Binders: Use composite wood products approved by the California Air Resources Board (ARB) as no-added formaldehyde (NAF) based resins or ultra-low emitting formaldehyde (ULEF) resins.

L. Entryway Systems: Walk-off systems to capture particulates shall be installed at least six feet long in the direction of entry travel at all entryways directly connected to the outdoors that are used as regular entry points by building users. Acceptable entryway systems include:

1. Permanently installed grates, grilles, or slotted systems that allow for cleaning beneath them
2. Permanently installed direct glue-down walk-off mats
3. Non-permanent roll-out mats, but only if a service organization is contracted for maintenance on a weekly basis

M. Air Filtration: Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 8 or better in all air handling units for processing both return and outside air that is delivered to the air supply system. Replace all filtration media after the completion of construction and prior to occupancy.

N. Lighting Controls: Install and calibrate controls as specified by Division 26 – Electrical in order to comply with LEED IAQ lighting controllability requirements.

O. Thermal Comfort: Install and calibrate controls as specified in Division 23 – Heating, Ventilation, and Air-Conditioning.

P. Fiberglass Insulation: Fiberglass batt insulation shall contain no formaldehyde-based binders or shall be third-party certified for conformance with Greenguard Children & Schools or Indoor Advantage Gold.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

A. Develop and implement a Construction Waste Management Plan (CWMP) quantifying material diversion by weight in order to recycle, reuse, and/or salvage at least 80% (by weight) of construction, demolition and land-clearing waste.

B. 100% of non-contaminated trees, stumps, rocks and associated vegetation and soils resulting primarily from land-clearing shall be reused or recycled.

C. Clean materials which are contaminated prior to placing in collection containers. Deliver materials free of dirt, adhesives, solvents, petroleum contamination and other substances deleterious to the recycling process.

D. Utilize any on-site existing paving materials that are scheduled for demolition as granulated fill or subbase material, and include the weight of this material in the calculations for material diverted from landfill disposal.

E. Arrange for materials collection by or materials delivery to the appropriate recycling or reuse facility.

F. Tax credits and other savings obtained or revenue generated for recycled or reused materials accrue to the Contractor.

G. Discuss CWMP procedures and measures as an agenda item at all regular job meetings conducted during the course of work at the site, and record progress in meeting minutes.

H. Submit monthly progress reports with Applications for Payment in accordance with Section 017419, documenting the status of the CWMP and current diversion percentage rates.

3.2 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Develop and implement a Construction IAQ Management Plan (CIAQMP) to prevent indoor air quality problems resulting from construction activities, including, at minimum, the following:

1. Construction activities must meet or exceed the minimum requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, 1995.
2. During construction, protect all absorptive materials stored on-site or installed from moisture damage as described in the Construction IAQ Management Plan (CIAQMP) defined above. Specifically:

    a. Exercise special care at all times in the storage of materials to prevent exposure to moisture.
    b. Avoid installation of gypsum wallboard and other porous materials until the building is weather-tight.
    c. All standing water which accumulates on interior floors shall be removed on the day that it is observed.
    d. Any drywall that has retained more than 20% moisture after 48 hours following exposure to moisture, or that has evidence of mold, must be disposed of in accordance with Specification Section 017419 “Construction Waste Management.”
    e. The contractor shall identify and remove all porous building materials that become wet or damaged by moisture within 7 calendar days of such exposure.

3. During construction and HVAC system installation, provide the Architect with photographs of IAQ management measures (such as protection of ducts and on-site or installed absorptive materials), including six photographs on three different occasions depicting implemented SMACNA approaches.

B. Air Filtration:

1. Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 8 or better in all air handling units for processing both return and outside air that is delivered to the air supply system; replace all filtration media after the completion of construction and prior to occupancy.
2. Install air filtration media that provides a Minimum Efficiency Reporting Value (MERV) of 8 or better for filtration media installed at return air grilles during construction if permanently installed AHUs are used during construction. Inspect weekly and replace as required.

C. Discuss CIAQMP procedures and measures as an agenda item at all regular job meetings conducted during the course of work at the site, and record progress in meeting minutes.

3.3 COMMISSIONING

A. Commissioning: All building energy-related systems and building envelope components shall be commissioned in accordance with the requirements of Specification Section 019100 “Commissioning Requirements” and related commissioning sections in other divisions in order to verify and ensure that fundamental building elements and systems are installed, constructed, calibrated to operate, and perform according to the Owner’s Project Requirements, Basis of Design, and Construction Documents.

END OF SECTION 018113

SECTION 019100 - COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Commissioning is a systematic process of ensuring that the building systems perform according to the design intent.

B. Commissioning during the construction phase is intended to achieve the following specific objectives:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document that equipment and systems perform according to the Owner's design intent and the Contract Documents.
3. Verify that Operations & Maintenance documentation left on site is complete.
4. Verify that the Owner's operating personnel are trained.

C. Deferred or seasonal commissioning may be required if commissioning during the construction phase does not fulfill the objectives listed above.

D. Commissioning augments but does not replace close-out procedures or other testing requirements contained in the Contract Documents.

1.2 RELATED DOCUMENTATION

A. Contract drawings, Division 0, Conditions of the Contract, and Division 1, General Requirements, apply to the Work of this Section.

1.3 RELATED SECTIONS

A. Form - Product Substitution.

B. Section 013300 Submittal Procedures.

C. Division 22 Plumbing Requirements.

D. Section 220800 Plumbing Commissioning Requirements.

E. Division 23 Mechanical Requirements.

F. Section 230800 Mechanical Commissioning Requirements.

G. Division 26 Electrical Requirements.

H. Section 260800 Electrical Commissioning Requirements.

I. Section 320800 Commissioning for Exterior Improvements (Irrigation).

1.4 COORDINATION AND RESPONSIBILITIES

A. The Commissioning Team includes:

1. The Owner, including an independent Construction Manager or Project Manager, if applicable (Owner's Representative)
2. Commissioning Authority (CA)
3. Architect and design engineers (Design Team)
4. General Contractor (Contractor)
5. Building or plant operator (Operator)

B. Responsibilities:

1. Owner's Representative Responsibilities

a. Provide Design Team with a Design Intent Document.
b. Review the pre-functional checklists and functional test procedures prior to testing.
c. When necessary, observe and witness pre-functional checklists, startup and functional testing of selected equipment.
d. Review commissioning progress.
e. Coordinate the resolution of non-compliance and deficiencies identified during commissioning.
f. Sign-off on individual commissioning tests as completed and passing
g. Assist the Contractor in coordinating the training of Owner's personnel.

2. CA Responsibilities

a. Direct and coordinate the commissioning activities and report to the Owner's Representative.
b. Provide an initial schedule of commissioning activities to the Contractor.
c. Coordinate with the Contractor to establish the schedule of commissioning activities.
d. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
e. Perform site visits, as necessary, to observe component and system installations.
f. Attend selected planning and job-site meetings to obtain information on construction progress.
g. Request and review additional information required to perform commissioning tasks, including control sequences, submittals, O&M materials, contractor start-up and checkout procedures and training agendas.
h. Develop and distribute pre-functional checklists, as necessary.
i. Develop and distribute functional test procedures, as necessary.
j. Coordinate, witness and approve functional tests performed by installing contractors.
k. Coordinate re-testing as necessary.
l. Participate in resolution of system deficiencies identified during commissioning.
m. Keep the Owner's Representative apprised of the status of commissioning related activities.
n. Coordinate and supervise seasonal or deferred testing and deficiency corrections.
o. Review and approve the content of the Operation & Maintenance (O&M) manuals.

p. Oversee and approve the training of the Owner's operating personnel.
q. Provide a final commissioning report (as described in this section).

3. Design Team Responsibilities

a. Attend the commissioning scoping meeting and selected commissioning team meetings.
b. Develop Basis of Design Document.
c. Perform normal submittal review, construction observation, record drawing preparation, etc. as contracted.
d. Review pre-functional checklists and functional test procedures prior to testing.
e. Participate in resolution of system deficiencies identified during commissioning.

4. Contractor Responsibilities

a. Include the cost of commissioning in the total contract price.
b. Integrate commissioning activities into the master schedule.
c. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
d. Review pre-functional checklists and functional test procedures prior to testing.
e. Complete pre-functional checklists as defined by the CA.
f. Execute functional performance testing as defined by the CA
g. Participate in resolution of system deficiencies identified during commissioning.
h. Coordinate the training of Owner's personnel.
i. Prepare O&M manuals including clarifying and updating the original sequences of operation to as-built conditions.
j. As-built drawing preparation
k. Participate in deferred and seasonal testing, if necessary and as required.

1.5 ABBREVIATIONS AND DEFINITIONS

A. Abbreviations:

1. CA: Commissioning Authority
2. Cx: Commissioning
3. O&M: Operations & Maintenance
4. TAB: Testing, Adjusting and Balancing

B. Definitions:

1. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
2. Basis of Design: Describes the systems, components, conditions and methods chosen to meet the design intent.
3. Data logging: Monitoring equipment using stand-alone data loggers separate from the building control system.
4. Deferred Testing: Testing performed after substantial completion due to partial occupancy, equipment, seasonal requirements, design or other site conditions that prevent testing from being performed during initial testing.
5. Deficiency: A condition in the installation or function of a component or system that is not in compliance with the Contract Documents and the Design Intent.

6. Design Intent: A document that provides an explanation of the ideas, concepts and criteria that are important to the Owner and therefore the intention of the design.
7. Factory Testing: Testing of equipment on-site or at the factory, by factory personnel with an Owner's Representative present.
8. Functional Testing: Test of the function and operation of equipment and systems using direct observation or monitoring methods. Functional Testing is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes of operation and are run through the control system's sequences of operation. Traditional TAB is not Functional Testing.
9. Initial Startup and Check-out: The initial starting of dynamic equipment, including executing pre-functional Checklists.
10. Non-Compliance: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or is not complying with the design intent.
11. 1Pre-functional Checklist: A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Contractor.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Test Equipment:

1. The Contractor shall provide testing equipment required to perform startup, initial checkout, and functional test procedures.
2. The Contractor shall provide two-way radios to assist in the commissioning process.
3. System specific test equipment, tools and instruments (e.g. test equipment specific to a piece of equipment) required for commissioning shall be included in the base bid price by the Contractor and retained by the Owner.
4. Data logging equipment and software required to test equipment provided by the CA, will not become the property of the Owner.

    a. Testing equipment shall be of sufficient quality and accuracy measure system performance with the tolerances listed in the Specifications

5. Equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
6. Control System Instrument Calibration:

    a. Field-installed sensors, gauges, and actuators shall be calibrated per the manufacturer's recommendations.
    b. Alternate calibration methods may be used, if approved by the Owner's Representative.
    c. Test instruments shall have had a certified calibration within the last 12 months.
    d. Sensors installed at the factory with provided calibration certification need not be field calibrated.

7. Measurement Tolerances, Standard Applications (Sensor and Required Tolerance (+/-))

    a. Outside air, space air, duct air temperature: 1.0 deg F.

b. Watt-hour, Voltage & Amperage: 1% of range.
c. Pressures, air, water and gas: 3% of design.
d. Flow rates, air: 10% of design.
e. Flow rates, water: 4% of design.
f. Relative humidity: 5%.
g. CO2 monitor: 0.1 %.
h. CO2 monitor: 75 ppm.

PART 3 - EXECUTION

A. Commissioning Plan:

1. The Commissioning Plan is an independent document issued by the CA to the Owner's Representative, Contractor, and Design Team near the start of construction. The plan is not a Contract document and if there is a conflict, the Specifications and Contract documents take precedence.

B. Commissioning Meetings:

1. Scoping Meeting:

a. The CA will schedule, plan and conduct a commissioning scoping meeting with the commissioning team.
b. Information gathered from this meeting will allow the CA to revise and reissue the Commissioning Plan.

2. Commissioning Meetings:

a. At the discretion of the CA, meetings will be planned and conducted as construction progresses. Typically the frequency increases as construction completion nears,
b. Commissioning meetings will be held as frequently as one per week.
c. These meetings will cover commissioning coordination and deficiency resolution.
d. There shall be a maximum of 6 separately scheduled commissioning meetings.

C. Reporting:

1. General Commissioning-Related Reporting:

a. The CA will keep the Owner's Representative apprised on the progress of commissioning.
b. The CA will communicate with members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes.
c. Testing or review approvals and non-conformance and deficiency reports are made with the review and testing as described in later sections.

2. Commissioning Work Products

a. The commissioning process generates a number of written work products. In summary, the written products are:

Product Developed By

Owner's Project Requirements (OPR)	Owner's Representative
Basis of Design Documents (BOD)	Design Team
Commissioning Plan (Cx Plan)	CA
Equipment Submittals	Contractor
Start-up and Initial Checkout Plan and Forms	Contractor
Prefunctional Checklists	CA
Final Testing and Balance report (TAB)	Contractor
Functional Test Procedures	CA
Operations & Maintenance (O&M) Manuals	Contractor
Overall Training Plan	Contractor
Deficiency Reports	CA
Final Commissioning Report	CA

3. Final Commissioning Report:

    a. The final commissioning report will include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope, a general description of testing and verification methods, and a brief description of commissioning results.
    b. Outstanding non-compliance items will be specifically listed. Future actions, commissioning process changes, etc. will also be listed.

D. Commissioning Submittals:

1. The CA will request specific equipment submittals be copied or routed to the CA for review and comments.
2. Commissioning submittal requests will be integrated into the normal submittal process and protocol of the construction team.
3. CA will review and comment on submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures.

E. Initial Start-Up And Checkout:

1. Parties responsible for Initial Start-up and Checkout for each system to be commissioned shall be identified by the Contractor.
2. The Contractor develops the Initial Start-up and Checkout plan using manufacturer's start-up and checkout procedures and other standard field checkout sheets.
3. The Contractor shall submit the Initial Start-up and Checkout plan to the CA for review and approval.
4. As necessary, the CA will further assist the commissioning team members in developing a more detailed Initial Start-up and Checkout plan.
5. The Initial Start-up and Checkout forms used for the Project shall include specific boxes or lines for recording and documenting specific inspections along with a summary statement and a signature block.

F. Pre-Functional Checklists:

1. The CA will develop, as necessary, Pre-functional Checklists above and beyond the Contractor's Initial Start-up and Checkout plan. The CA will issue sample Prefunctional Checklists.

2. The Initial Start-up and Checkout plans and Pre-functional Checklists are executed by the Contractor, who may assign this task to a Sub-contractor, vendor, or other party responsible for equipment installation.
3. The CA will observe Initial Start-up and Checkout of selected equipment.
4. Within two days after completion of the start-up and initial checkout plans and Pre-functional Checklists, the Contractor shall provide the CA with a signed and dated copy of the completed Prefunctional Checklists.
5. Only individuals that have direct knowledge of an item on the Prefunctional Checklists shall initial that item.
6. The Contractor shall clearly list outstanding items that were not successfully completed, at the bottom of the relevant checklist.
7. The Contractor shall clearly list items not in conformance with the Pre-functional Checklists.
8. The responsible party shall correct areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction
9. The Pre-functional Checklists shall be repeated, as necessary, for deficient items, after the deficiencies have been corrected.
10. Items left incomplete, which later cause deficiencies or delays during Functional Testing shall result in back charges to the responsible party.

    a. The CA will accept or reject each Prefunctional Checklist submittal.

G. Functional Performance Testing:

1. Objectives and Scope:

    a. The objective of Functional Performance Testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents.
    b. Functional Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation.
    c. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
    d. Each system to be commissioned will be operated through all modes of operation (e.g. seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load). Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

2. Development of Test Procedures:

    a. Before test procedures are written, the CA will obtain requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters.
    b. The CA will develop specific test procedures to verify and document proper operation of each piece of equipment and system.
    c. Prior to the execution of the test procedures, the Contractor and Design Team will review and comment on the test procedures.
    d. The CA will review Owner’s contracted, factory testing or required Owner’s acceptance tests which the CA is not responsible to oversee, including documentation format, and will determine what further testing or format changes are required to comply with the Specifications. Redundancy of testing will be minimized.

e. The purpose of specific tests is to verify and document compliance with the stated criteria of acceptance.
f. The test procedure forms developed by the CA will include (but not be limited to) the following information:

1) System and equipment or component name(s).
2) Equipment location and ID number.
3) Unique test ID number.
4) A copy of the specific sequence of operations or other specified parameters being verified.
5) Required pre-test field measurements.
6) Instructions for setting up the test.
7) Specific step-by-step procedures, in a clear, sequential and repeatable format.
8) Acceptance criteria of proper performance with a specific area for clearly marking whether or not proper performance of each part of the test was achieved.
9) A section for comments.
10) Signature blocks for the participating parties.

3. General Functional Testing Methods

a. Functional Testing will be achieved by manual testing and by monitoring the system performance and analyzing the results using the control system's trend log capabilities or by stand-alone data logging equipment.
b. Functional Testing Sequence:

1) Functional Testing is conducted after Prefunctional Checklists and Initial Startup and Checkout have been accepted by the CA.
2) The air and water balancing is completed, reported to the CA and debugged before Functional Testing of air-related or water-related equipment or systems.
3) Functional Testing proceeds from components to subsystems to systems. When proper performance of interacting systems has been achieved, the interface or coordinated responses between systems is checked.

c. Functional Testing Setup:

1) Each functional test shall be performed under conditions that simulate actual conditions as close as is practically possible.
2) The Contractor executing the test shall provide necessary materials and system modifications to produce operating conditions necessary to execute the test.
3) At completion of the test, the Contractor shall return affected building equipment and systems to their pre-test condition.

d. Functional Testing Sampling:

1) At the discretion of the CA, multiple identical pieces of equipment may be functionally tested using a sampling strategy.
2) No sampling shall be used in Prefunctional Checklist execution.

4. Coordination and Scheduling:

a. The Contractor shall incorporate commissioning items into the construction schedule.
b. The Contractor shall provide sufficient notice to the CA regarding their completion schedule for the Prefunctional Checklists and startup of equipment and systems.
c. The CA will schedule functional tests through the Contractor.
d. The CA shall direct, witness and document the Functional Testing of equipment and systems.
e. The Contractor shall execute the tests.

5. Control Signal Manipulation:

a. Actual Conditions: Testing system and equipment to experience actual operating conditions and legitimate control signals is preferred, although it will not be feasible that the system to be commissioned will experience the full range of operating conditions within the scheduled testing period.
b. Simulated Conditions - Simulating conditions shall be used as necessary in order to test the systems in all operating conditions:
c. Overwritten Values - Overwriting sensor values to simulate a condition shall be employed sparingly. The Contractor will overwrite values and alter setpoints at the discretion of the CA.
d. Simulated Signals - Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants will be generally preferred over using the sensor to act as the signal generator via simulated conditions or overwritten values.
e. Altering Setpoints - Altering system setpoints to test a sequence is acceptable and will be employed as necessary in the Functional Testing.

6. The CA may recommend solutions to problems; however the burden of responsibility to solve, correct and retest problems is with the Contractor and Architect.

H. Operations & Maintenance Documentation:

1. The Contractor shall provide the Owner's Representative with complete Operations and Maintenance (O&M) information.
2. Prior to substantial completion, the CA will review the O&M submittals, manuals and documentation for systems that were commissioned.

a. General:

1) Bound in labeled binder liberally divided with tabs, or provided electronically, to provide efficient access.
2) Name, address and telephone number of the manufacturer or vendor and installing Contractor.
3) Submittal data.
4) O&M instructions with the model and features for this site clearly marked.

b. Data Requirements Include:

1) Instructions for installation, maintenance, replacement, startup, special maintenance and replacement sources, a parts list, a list of special tools, performance data, and warranty information.

c. Additional Documentation:

1) Documentation package on as-built controls that includes a narrative for normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls setup and programming, troubleshooting, alarms, control drawings and schematics and final sequences of operation.

3. The CA will return the submittals to the Owner's Representative or Contractor, in compliance with the Project submittals procedure. The CA will review and comment on O&M manual submittals for commissioned systems. This review does not supersede the Architect's review of the O&M manuals according to the Architect's contract.

I. Operations & Maintenance Training:

1. The Contractor shall be responsible for training coordination and scheduling, and ultimately for ensuring that training is completed for commissioned systems. The following should be addressed during training:

   a. General purpose of the system (design intent).
   b. Use of O&M manuals.
   c. Review of control drawings and schematics.
   d. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
   e. Interactions with other systems, adjustments and optimizing methods for energy conservation, relevant health and safety issues.
   f. Adjustments and optimizing methods for energy conservation.
   g. Relevant health and safety issues.
   h. Special maintenance and replacement sources.
   i. Tenant interaction issues.
   j. Discussion of how the feature or system is environmentally responsive.

2. The CA will be responsible for overseeing and approving the content and adequacy of the training of Owner's personnel for commissioned equipment.
3. The CA develops criteria for determining that the training was satisfactorily completed.
4. At the Owner's Representative's discretion, the Owner's Representative may provide videotaping of the training sessions and have the tapes added to the O&M manuals.

J. Non-Compliance:

1. The CA will record the results of the Functional Testing on the procedure or test form. Deficiencies or non-compliance issues will be noted and reported to the Contractor.
2. Corrections of minor deficiencies identified shall be executed by the Contractor during the tests. In such cases the deficiency and resolution will be documented on the procedure form.
3. As tests progress and deficiencies are identified, the CA will inform the Contractor and the Owner's Representative.
4. When there is no dispute on the non-compliance issue and the Contractor accepts responsibility to correct it:

   a. The CA documents the deficiency and the Contractor's response and intentions and proceeds with another test or sequence.
   b. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.

5. If there is a dispute about a non-compliance issue, regarding whether it is a deficiency or who is responsible:

    a. The deficiency will be documented by the CA.
    b. The Contractor shall provide a written response to the deficiency.
    c. The Architect will provide a written response to the deficiency.
    d. The Owner's Representative will determine the responsible entity and the appropriate resolution.
    e. The CA will document the resolution process.
    f. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency (if necessary). The CA reschedules the test.

6. The cost for a Contractor to repeat a Prefunctional Checklist or Functional Test, if they are responsible for the deficiency, shall be theirs. If the Contractor is not responsible, cost recovery for repeating will be negotiated with the Contractor.
7. For a deficiency identified, not related to a Prefunctional Checklist or start-up fault, the following shall apply:

    a. The CA will direct the retesting of the equipment once at no charge to the Owner.
    b. The CA's time for additional tests will be charged to the Owner, who may choose to recover costs from the responsible party.

8. The time for the CA to direct retesting required because a specific Prefunctional Checklist item, reported to have been successfully completed, but determined during Functional Testing to be faulty, will be charged to the Owner, who may choose to recover costs from the party responsible for executing the faulty Prefunctional Checklist.
9. Retesting will not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

K. Project close-out:

1. The commissioning process will be completed when the systems operate according to the Owner's design intent and the Contract Documents, as determined by the CA.
2. The commissioning process may continue past substantial completion of the Project, until non-compliance issues have been resolved.

END OF SECTION 019100

SECTION 031000 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Principal Work in this Section

1. Forms for cast-in-place concrete.
2. Shoring, bracing, accessories and form coating.

B. Work installed but furnished in other Sections

1. Inserts, bolts, anchors and other items furnished by other trades for installation in formed concrete.

C. Related Work

1. Section 033000 – Cast-in-place Concrete

1.2 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. Records: Keep an accurate record of the dates of all form removal and furnish copies to the Construction Manager.

C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

D. LEED Submittals

1. Recycled Content (MRc4):

a. Submit product data or other published information indicating total weight of product to be provided for the Project, percent of post-consumer recycled material by weight and percent of post-industrial recycled material by weight. Include material costs (excluding costs of installation).
b. Include information on Material Tracking Worksheets.

2. Material Source (MRc5):

a. Submit product data or other published information verifying the location of manufacturing facility including name, address, and distance between manufacturing facility and the project site. Provide manufacturer's documentation indicating location where the base materials were extracted, mined, quarried, harvested, etc. and the distance between this location and the project site. Also include material costs (excluding costs of installation).

E. Include information on Material Tracking Worksheets.

1.3 QUALITY ASSURANCE

A. Lumber and plywood shall be grade-marked by a grading agency acceptable to the Building Department.

1.4 HANDLING

A. Procedure: In compliance with Section 016000.

B. Storage: Store form facing materials above ground on framework or blocking. Protect from moisture and damage. Handle form facing materials to prevent damages which could be transferred to the concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms for Exposed Concrete Surfaces

1. General: Plywood, metal, metal-framed/plywood-faced, or FRP which will provide continuous, flat, exposed concrete surface with the appropriate texture and appearance as specified on the architectural drawings. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings, where indicated.
2. Type:

a. For concrete surfaces to be sacked and rubbed: US Product Standard PS-1 'B-B (Concrete Form) Plyform", Class 1, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
b. Elsewhere where concrete will remain exposed, with or without a mechanical finish: Overlaid plywood complying with US Product Standard PS-1 'A-C or B-B High Density Overlaid Concrete Form,' Class 1, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for concealed concrete surfaces: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Ties and Spreaders

1. Provide cone or snap type ties designed to be completely removed from wall, or to break off and provide minimum 1-1/2 in. coverage over ends of the portion of snap tie remaining in the concrete.
2. Do not use wire ties, wood spreaders, or embedded types in which embedded portion is less than 1-1/2 in. from exterior face of concrete.

D. Chamfer strips: Extruded PVC, with 3/4 in. diagonal faces unless otherwise indicated, by The Burke Co., Greenstreak Plastic Products Co., or Sonneborn-Rexnord, Inc., or oiled softwood shapes with the same profile.

E. Form coatings: Commercial formulation form-coating compounds that will, not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

F. Prefabricated construction joint keyways: Key-Loc by Form-A-Key Products Div., or Keyed Kold Joint by The Burke Co., complete with all accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive concrete formwork and associated work and conditions under which work will be installed. Do not proceed until satisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of the work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 FORM TYPES

A. General: Comply with the applicable provisions of ACI 347, Guide to Formwork for Concrete, and APA Design/Construction Guide, Concrete Forming.

1. The design and construction of forms and shoring is the Contractor's responsibility but shall comply with specified requirements.
2. Form contact surfaces shall be clean, free from dents, holes and other imperfections.
3. Establish and maintain benchmarks mines and controls necessary to achieve specified tolerances. Take an accurate; survey of the form location just prior to concrete pour.

B. Earth Bank

1. Except for exterior face of wall footings and grade beams which must be formed, earth banks may be used to form footings and grade beams if the soil is firm, neatly trimmed, and will retain concrete in the required size and shape.
2. The concrete coverage shall be increased as noted on the Drawings when concrete is cast against earth.

C. Wood Forms

1. Construct with plywood panels as large as practicable. Where because of their height walls or columns have a horizontal form joints, the horizontal joint shall be aligned throughout the same floor, or area, unless otherwise acceptable to the Construction Manager.
2. Concrete surfaces which will remain exposed in the Work:

    a. Fill voids, fastener heads, and other imperfections in form contact surfaces with body putty sanded smooth.
    b. Seal joints between plywood panels flush with compound specifically designed to seal forms, or other approved material to prevent concrete paste leakage.
    c. Provide sharp, clean comers at form intersecting planes, without visible edges and offsets. Back joints with additional studs or girts.
    d. Form recesses and projections with smooth finish materials, and install in forms with sealed joints to prevent displacement.
    e. Drill holes accurately in forms to fit ties used. Prevent leakage of concrete around tie holes. Do not drive ties through undersized or improperly prepared holes.

3. Kerf backside of wood inserts used for forming keyways, regrets, recesses and similar treatments, to allow wood to swell without spalling concrete, and to assure easy removal.

D. Metal Forms

1. Fasten sections of forms tightly and interlock securely.
2. Provide precisely cut openings required by other trades.
3. Cut or drill forms for attaching sleeves or other items to be embedded in concrete.

E. Re-use of Forms

1. Form materials may be re-used if they produce finished surfaces equal to finished surfaces where new form materials are used.
2. Before re-use, thoroughly clean, recondition in every respect, suitable for their reuse purpose.

F. Tolerances: To obtain cast-in-place concrete not exceeding the tolerances specified in Section 033000, except support form facing material to limit deflection to L/360 between supports for concrete.

3.3 FORM CONSTRUCTION

A. Construction

1. Rigidly support and construct forms to the lines, surfaces and profiles necessary to produce concrete of the design indicated.
2. Construct forms to be removable without prying against concrete.
3. Make forms tight, without cracks or holes, to prevent leakage of mortar or loss of fine particles from concrete.
4. Cover or fill holes that are not used and cracks that have opened-up flush with adjacent surfaces.

B. Wales and studs: Of adequate size and spacing to prevent form failure and to obtain concrete within the tolerances specified.

C. All formwork shall be cambered as specified on drawings.

D. Ties and spreaders: Place ties symmetrically, equally spaced, in plumb and level rows; tie placement in exposed concrete is subject to the Construction Manager's approval. Do not permit wood, other than built-in treated bucks or nailing blocks, to remain permanently in the forms.

E. Form contact surfaces

1. As specified above and as best suited to prevailing conditions; may be constructed of plywood, FRP, plastic, or steel.
2. Block plywood edges which do not occur at bearing points to eliminate joint offsets.

F. Special features

1. Corners

a. Form exposed corners between beams and columns to produce a square, smooth, solid joint without paste leakage.
b. Install chamfer strips in corners of all other forms, unless otherwise indicated. Miter chamfer strip at changes in direction.
c. Corners which will be concealed in the Work may be formed either square or chamfered.

2. Reglets, rebates, seats and pockets: Form as indicated or as necessary to receive or engage work of other trades.
3. Openings, chases and recesses:

a. Form as indicated or necessary to receive, pass and clear other work.
b. Verify sizes and locations with other trades before forming.
c. Closely cooperate in locating boxes, cans and sleeves furnished by other trades.

G. Form release agent: Thoroughly clean forms and coat with release agent prior to initial use (except when mill-oiled) and before each reuse.

1. Apply form coating in compliance with its manufacturer's printed instructions and coverage rates.
2. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.
3. Provide a coating of uniform thickness. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete against which fresh concrete will be placed.
4. Apply form coating before reinforcement is placed.

3.4 FORM REMOVAL

A. Remove forms only after concrete has developed sufficient strength to not be damaged by form removal operation, and to safely sustain its own weight and superimposed loads, as determined by testing field cured concrete cylinders and as scheduled below, but not sooner than specified in ACI 347.

1. Shoring and Reshoring:

a. Be solely responsible for the safety of all construction including the periods during and after the preparation and erection of formwork, placement of concrete, formwork removal, reshoring and removal of reshoring. No act of others shall relieve the Contractor of the sole responsibility for safety.
b. General: Formwork, shoring and reshoring shall relate to the structural systems on each floor. Shoring and reshoring must be aligned over and under beams and girders and spreader beams provided where necessary to transfer loads. Shoring for flat slab systems must be aligned over reshores with spreader beams where necessary to transfer loads to reshores.
c. General: Do not remove forms or shoring until members have acquired sufficient strength to support their weight and subsequent construction load without deflection exceeding L/360. Remove forms in a manner to maintain the strength and stability of the structure at all times. Determine time of removal per specified minimum removal times in the following table and lengthen as necessary by job conditions, weather, etc. No stripping allowed before concrete has cured sufficiently to prevent spalling, chipping, or other damage due to form removal.

Area	Time with Supplementing Control Cylinders	Time without Supplementing Control Cylinders	Min. percent of Specified 28 day Cylinder Strength
Beam and column side forms	1 day	2 days	35 percent
Wall forms	1 day	2 days	35 percent
P-T slab soffit forms	3 days	7 days	70 percent
Beam, girder and flat slab soffit forms	14 days	28 days	100 percent

B. Take care when removing forms that concrete surfaces are not marred or gouged, that comers are true, sharp and unbroken. Do not pry against concrete when removing forms.

C. Cut-off nails flush in concealed concrete surfaces. Cut back tie wires and nails in exposed concrete surfaces at least 1-1/2 in. Remove rod and cone ties and separators or similar devices and pull inward away from finished surfaces.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:

1. Reinforcing steel (rods and mesh) for cast-in-place concrete.
2. Accessories such as chairs and tie wires.

B. Related work in other Sections:

1. Section 033000 - Cast-In-Place Concrete.
2. Section 053000 - Steel Decking.
3. Section 042220 - Concrete Masonry Units.

1.2 SUBMITTALS

A. Procedure: In compliance with Division 1.

B. Shop drawings: Submit for reinforcement deviating from that shown on the Drawings.

1. Submit bar drawings and schedules with the corresponding placing diagrams. Drawings shall be complete for any specific area of Project when submitted.
2. Reinforcing shop fabrication and field placement drawings shall be submitted in an acceptable form, be checked and complete. Reuse of the Contract Documents is not permitted. Each submittal shall be provided at least five weeks in advance of reinforcing delivery to site.
3. Reinforcement shall be detailed based on construction joint locations that have been shown on shop drawings, as reviewed. Construction joints shall be indicated on reinforcing shop drawings. Submit proposed construction joints for review prior to submittal of reinforcing shop drawings.
4. The drawings shall be in such detail as to assure that there will be a minimum, if any, of difficulties in execution of the work in the field. Show layout of reinforcing by mark for each member on plan. For each member or collinear series of members, show side elevation of the member with top, bottom and tie reinforcing and spacings shown. Show cross section of each pertinent location. Show all bar lengths and dimensioned bar bending details for each bar type. The detailed bar listing shall be shown on a member-by- member basis indicating the number of bars of each type etc. Clearly show splicing and placing conditions at each splice area. Detail pilaster verticals with respect to beam, and anchor bolts. Placement diagrams shall clearly indicate locations of beam reinforcing passing through verticals and anchor bolts. Placement diagrams shall clearly show layering of beam reinforcement and slab reinforcement locations relative to beams. Walls shall be shown in side elevations of each wall face indicating vertical, horizontal and beam reinforcing with sections showing placement.

5. The drawings shall consist of sections, plans and details clearly showing locations, sizes and spacing of all reinforcing steel, supporting bars and accessories. Include particular details at foundation-column intersections showing locations of vertical and horizontal reinforcing. Include detailed schedules and diagrams to indicate bends, sizes and lengths of all reinforcing steel items and clear cover for reinforcing.
6. Floor openings, wall openings, wall recesses and sleeves for all mechanical, plumbing and electrical work shall be coordinated with the respective trades and reinforcing shown on these drawings in accordance with the criteria indicated on the drawings.
7. After review, furnish all copies needed for fabrication and erection, and for the coordination and use of other trades.
8. Be fully responsible for furnishing and installing all materials called for or required by the Contract Documents even though these materials may have been omitted from the reviewed shop drawings or incorrectly indicated thereon.

C. Mill reports: Submit copies of mill reports and test data for reinforcing steel sampled and tested, prior to starting this work.

D. Proprietary splicing details.

E. Mill Certificates: Submit to Architect, three (3) copies of manufacturer's certificates of reinforcing steel mill tests.

F. Provide alignment templates at top of pilaster cage to maintain position of vertical bars such that the proper location of beam bars passing through the pilaster and anchor bolts is assured.

1.3 QUALITY ASSURANCE

A. Source quality control: Obtain mill reports for all types and sizes of reinforcing steel.

1. Mill reports shall contain the steel source, description, heat number, yield point, ultimate tensile strength, elongation percentage, bend test and chemical analysis.

    a. If the reports show that material is satisfactory, no tests will be required.
    b. For foreign steel, testing as specified below will be required by a testing laboratory acceptable to the Architect.
    c. For foreign steel, testing as specified below will be required by a testing laboratory acceptable to the Architect.

2. Ensure that the material delivered for use is that represented by the mill reports and obtain copies of mill reports, examine them, certify whether the material represented complies with Specifications requirements, and make distribution of reports as required. Report chemical composition of each heat, as determined by ladle analysis.
3. Where materials proposed for use cannot be identified, pay for an approved testing laboratory to make one series of tests (tensile and bend) from each 2.5 tons, or fraction thereof, of each size and kind of reinforcing steel. Include 2 samples, minimum, of sufficient length to allow tests to be made on the as-rolled bar.

1.4 HANDLING

A. Procedure: In compliance with Section 016000.

B. Electrode storage: Comply with the combined recommendations of AWS and the electrode manufacturer for storage of electrodes. Do not use electrodes that have been wetted.

C. Delivery: Deliver reinforcement to the site bundled, tagged and marked; handle to prevent damage to material. Use metal tags indicating size, length and other markings shown on placement drawings. Maintain tags after bundles are broken.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing steel: Use ASTM A 615, Grade 60 for gravity elements. For welding, conform to specified carbon equivalent or use bars conforming to ASTM A 706.

B. Reinforcing mesh: ASTM A 185. Provide welded wire fabric in flat sheets, not rolls.

C. Welding electrodes for Reinforcing Bars: AWS A5.1 E80XX Series, low hydrogen, having a minimum yield point of 80,000 psi.

D. Tie wire: ASTM A 82, 16 gage (minimum) annealed steel wire.

E. Supports for reinforcement: 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 specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs, or pre-cast concrete block chairs with embedded wire ties.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
3. Over waterproof membranes and vapor barriers, use pre-cast concrete chairs to prevent puncturing of membrane.

2.2 FABRICATION

A. General: Except as modified by the Drawings and the Specifications, comply with Chapter 7 of CRSI Manual of Standard Practice for fabrication of reinforcing steel. Exposed Sealing Materials: All sealing materials exposed at entrance and storefront perimeter joints in contact with adjacent cladding materials: 2 component silicone, refer to Division 7 Section "Joint Sealants".

B. Bending and forming:

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs, or pre-cast concrete block chairs with embedded wire ties.
2. Heating reinforcement for bending is prohibited. Do not install bars with unscheduled kinks or bends.
3. Bars larger than #4 shall not be bent once cast in concrete or masonry.

C. Tolerances: Comply with ACI 117.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive concrete reinforcement and associated work and conditions under which work will be installed. Do not proceed until satisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of the work within a particular area will be construed as Installer's acceptance of surface conditions.

3.2 PLACING

A. Placement inspection: Place reinforcement under the continuous inspection of the Owner's Testing Agency.

B. Cleaning: Clean reinforcement of loose mill scale, excessive rust, oil, and other coating that might destroy or reduce its bond before placing it.

C. Placing: Comply with the listed reference standards as applicable.

1. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
2. CRSI, Manual of Standard Practice.
3. AWS D1.4, Structural Welding Code - Reinforcing Steel.

D. Spacing of reinforcement: Space reinforcement to maintain the proper distance and clearance between parallel bars and between bars and forms.

3.3 WELDING

A. Welding: Comply with the requirements of AWS D1.4. Before welding, determine the weldability of reinforcing bars by laboratory chemical analysis of the steel. Only steel conforming to the chemical requirements specified in AWS D1.4 may be welded.

B. Welded splices: Use full penetration butt welds made by the electric-arc method unless indicated otherwise.

1. Use only welders who have passed the AWS standard qualification tests within the previous year.
2. Weld splices shall develop 125% of the specified yield strength of the reinforcing bars, or of the smaller bar in transition splices.
3. Clean bars of oil, grease, dirt and other foreign substances, and flame-dry before welding.
4. Prepare ends of bars in compliance with AWS D1.4. Preheat bars before welding.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:

1. Cast-in-place concrete.
2. Concrete floors, walls, curbs, and slabs on grade and over metal decking.

B. Work installed but furnished in other Sections:

1. Items to be embedded in concrete.

C. Related work in other Sections:

1. Section 032000 - Concrete Reinforcement.
2. Section 036000 - Grout.
3. Section 053000 - Steel Decking.

1.2 SUBMITTALS

A. Procedure: In compliance with Division 1.

B. Data: Manufacturers' brochures and technical data for all manufactured products.

C. Certificates:

1. Cement certification.
2. Admixture certification: Include chloride ion content.
3. Batch plant tickets.

D. Concrete mix designs for approval: Certified concrete mix designs for initial and any subsequent changes in mix designs.

1.3 QUALITY ASSURANCE

A. Mock-up: Before beginning work, cast a sample panel of each type of finish at a location on the site agreed-upon with the Architect.

1. Protect panel until its removal is authorized by the Architect. Make such modifications as necessary to achieve a panel satisfactory to the Architect.
2. Approved panel shall serve as the standard for all remaining work. Remove panel only after completion and acceptance of work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland cement: ASTM C 150, Type II low alkali, typical, Type V for all elements in contact with earth. Do not change source, brand or type of cement without Architect's written approval.

B. Fly ash: ASTM C 618, Type C or F. Do not change source, brand or type of fly ash without Architect's written approval.

C. Aggregates: Submit pit source and characteristics of each type aggregate to Architect prior to designing mixes.

1. Hardrock aggregates: ASTM C 33 graded so that coarse aggregate nominal size is not larger than 1/5 of the narrowest dimension between form faces; nor 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars, whichever is less, but never greater than ¾ inch in any dimension for slabs 4 inches thick or less; 1-1/2 inches at all other locations.
2. Lightweight structural concrete: Mixed of Portland cement, sand, coarse lightweight aggregates, an air-entraining admixture and water. Testing laboratory shall design lightweight structural concrete in accordance with ACI 211.2 for 28-day compressive strengths required by Drawings or specified herein, with weight not exceeding 110 lbs. per cubic foot air dry. Trial batch strengths shall be as specified above. Lightweight structural concrete shall meet the drying shrinkage requirements specified.

D. Admixtures:

1. May be used only with the Architect and the Building Department approval.
2. Submit manufacturer's data for products proposed for use to the Architect in compliance with the requirements of Section 013340.

E. Water: Fresh, clean, potable, and free of oil and other materials injurious to concrete.

F. Structural adhesive: ASTM C 881, 2-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.

1. Rezi-Weld 1000 by WR Meadows.
2. Thiopoxy by WR Grace.
3. Sikadur Hi-Mod by Sika Chemical Corp.
4. Patch and Bond Epoxy by The Burke Co.

G. Sealer: One of the following.

1. Cure-Hard by WR Meadows (sodium silicate).
2. Ashford Formula by Curecrete Chemical Co. (sodium silicate).
3. Lapidolith by Sonneborn (magnesium or zinc fluosilicate).
4. Chem Hard (magnesium fluosilicate), Fluohard (magnesium fluosilicate) or Seal Hard (siliconate/sodium silicate) by L&M Construction Chemicals, Inc.
5. Saniseal 50 by Master Builders Co. (magnesium or zinc fluosilicate).

H. Curing compound:

1. Liquid membrane-forming compound complying with ASTM C 309, Type I (1D), Class B, guaranteed not to affect the appearance of the concrete surfaces, and the bond, adhesion, or effectiveness of finishes and surface treatment specified herein to be applied to concrete.
2. Curing compound used on exposed concrete surfaces shall be non-discoloring, fast drying and shall be conclusively demonstrated not to darken or yellow with age.
3. Curing compound for use on concrete floors to receive adhered covering shall be specially formulated for such use and shall be certified by the manufacturer not to inhibit the bonding qualities of flooring adhesives.

I. Dry-pack and grout: One of the following with minimum of 5,000 psi compressive strength at 28 days: See Section 036000.

1. Masterflow 713 by Master Builders.
2. Five Star Grout by US Grout Corp.

J. Expansion joint materials:

1. Joint filler: Use in combination with plastic joint cap made by Greenstreak, Quaker Plastic Corp., WR Meadows, or equal.

a. Homex Expansion Joint by Homasote Co., or equal non-bituminous product compatible with sealant specified in Section 07920.
b. Sealtight self-expanding cork by WR Meadows, or equal compatible with sealant specified in Section 07920.

2. Joint sealant and back-up rod: As specified in Section 079200.

K. Curing paper: Orange Label Sisalkraft by Fortifiber Corp., or equal.

L. Water stop: One of the following.

1. Waterstop-Rx by Cetco.
2. Waterstop-Plus by Intercontinental Chemical and Equipment, Inc. (Waterstop-Plus is extruded from a cartridge sealant.)
3. Bluestop by Vinyltex Corp.

2.2 SOURCE QUALITY CONTROL

A. Employ a testing laboratory, acceptable to the Owner and Architect, to test the materials for conformance with these Specifications before concrete mixes are established and when source is changed, unless recent test results of materials to be used on the Project, performed by an acceptable testing laboratory, are accepted by the Architect.

B. Testing coarse aggregates:

1. Test aggregates before and after concrete mix is established and whenever the character source of material is changed, but not less than one test for each 500 cubic yards.
2. Perform a sieve analysis to determine conformity with limits of gradation. Perform sampling and testing according to ASTM C 33, and as follows:

a. Sampling of aggregates: ASTM D 75. Take samples of aggregates at source of supply, or if source of supply has been approved, from storage bunkers at ready-mixed concrete plant.
b. Testing of aggregates shall include:

1) Sieve analysis: ASTM C 136.
2) Organic impurities: ASTM C 40. Fine aggregate shall develop a color not darker than the referenced standard color.
3) Soundness: ASTM C 88. Loss after 5 cycles not over 8% for coarse aggregate, nor 10% for fine aggregate.
4) Abrasion: ASTM C 131. Weight loss not over 10-1/2% after 100 revolutions, nor 42% after 500 revolutions.
5) Deleterious materials: ASTM C 33.
6) Materials passing No. 200 sieve: ASTM C 117, not over 1% for gravel, 1.5% for crushed aggregate per ASTM C 33.
7) Reactive materials: ASTM C 289. Aggregates shall indicate no potential deleterious reactivity.
8) Definitions: ASTM C 125.

3. Cement test:

a. The cement mill laboratory will be acceptable as testing laboratory for this purpose when approved by the Building Department. Submit evidence to show that the cement mill laboratory is qualified to perform tests. The laboratory shall make tests for every 500 barrels or fraction thereof of cement used, in compliance with ASTM C 150.
b. Make tensile strength test at 7 days. Tag the cement for identification at the location of sampling. A representative of the Testing Agency shall certify that materials being used are taken from the lots sampled and tested for this report.

2.3 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

1. Requirements of Mix designer:

a. List design mixes required, stating where each applies, and identified as follows:

1) "(3-57 AR Col)" which interpreted means 3000 psi, Size 57 agg., air-entrained retarder used for columns.

b. Design concrete mixes subject to controls specified under Paragraph, "Proportioning", including adjustments for seasonality.
c. Verify adequacy of design mix for compressive strength in accordance with ACI 301, Method 1 or Method 2 as hereinafter modified.

1) Method 1: Make and test compressive test cylinders in accordance with appropriate ASTM procedures to substantiate an average compressive strength as specified in Paragraph, "Proportioning".
2) Method 2: Appropriate field test data for concrete made with the same ingredients may be used. Thirty (30) or more consecutive strength test results of mixes with same materials and proportions used in similar construction and climatic conditions within past year shall be used to indicate performance in accordance with specification. Required average compressive strength shall be specified in Paragraph, "Proportioning".

d. Adjust mix designs that prove unsatisfactory in use, subject to Architects review. Concrete that does not consistently exhibit specified control characteristics shall be considered unsatisfactory. All work constructed with such concrete shall be removed and replace by Contractor.

2. Submit for Architects Review.

a. List of mixes.
b. Mix Proportions.
c. Proposed adjustments for seasonality.
d. Test results and/or mill certificates showing that mix proportions and materials comply with performance characteristics specified.
e. A concrete mix design submittal shall include the proposed mix components and quantities, material sources, aggregate gradations, manufacturer's data sheets for admixtures, etc. As well as actual strength and slump data for trial mix or historical data statistically summarized. Relative to semi-lightweight concrete also include splitting strength, modulus, shrinkage unit weight and other information as well as identify if the materials are vacuum saturated or not and the supplies description of their product. The mix sheet shall clearly indicate location of use, a pumped or place mix, and other conditions of proposed usage.

C. Proportioning:

1. Structural Concrete:

a. Water reducing (plasticizing) admixture required.
b. Trial Mix: Determine average compression strength by ACI 301, Method 1 with minimum of 15% greater than specified f'c or by Method 2 where average strength exceeds specified strength f'c by at least:
c. 400 psi if standard deviation is less than 300 psi.
d. 530 psi if standard deviation is 300 psi to 400 psi.
e. 690 psi if standard deviation is less that 400 psi to 500 psi.
f. 898 psi if standard deviation is less that 500 psi to 600 psi.
g. 1131 psi if standard deviation is less than 600 psi to 700 psi.

2. Minimum Cement Content: (94 pounds per bag)

a. 3000 psi concrete: 5 bags per cubic yard. Maximum water 6.3 gallons per bag.
b. 4000 psi concrete: 5-3/4 bags per cubic yard. Maximum water 5.5 gallons per bag.
c. Pumped concrete: Increase minimum cement content as required to maintain equivalent water/cement ratios to those required for strengths of non-pumped concrete.

d. Maximum Water/Cementitious material ratio is 0.50 unless noted otherwise in project plans.

3. Exterior Exposed Concrete:

a. Air entrainment and water reducing admixtures as required. Do not add air entrainment agents to concrete to be abrasive blasted.
b. Minimum Cement: 5-1/2 bags per cubic yard.
c. Maximum Water: 5-1/2 gallons per bag.

4. Semi Lightweight Structural Concrete:

a. Dry Weight: 110 pounds per cubic foot
b. Splitting Tensile Strength: When tested in accordance with ASTM C496, minimum as follows for given compressive strength.
c. Modulus of Elasticity: Minimum 2,400,000 pounds per square inch (secant modulus at 0.3 f'c).
d. Cement Factor and Water-Cement Ratio: Base on degree of saturation and absorption characteristics of lightweight aggregates stockpiled for use.
e. Shrinkage Compensated Cement: May be used to control drying shrinkage if acceptable to Architect.
f. Natural Sand: ASTM C33 Substitute for lightweight fines.

5. Pumped Concrete:

a. Aggregates:

1) Maximum Size: One-third maximum opening in either pump or pipeline, whichever is smaller.
2) Grading: As close as possible to middle of ASTM C33; for normal weight concrete and ASTM C330 for semi lightweight concrete grading range.
3) Fine Aggregate Fineness Modulus (FM): 2.4 to 3.0 with 15 to 30 percent passing number 50 sieve and 5 to 10 percent passing number 100 sieve.
4) Daily Variation in Fineness Modulus (FM): 0.20 from value used in selecting proportion.
5) Lightweight Aggregate Moisture Content: At least equal to 24-hour absorption percentage when tested in accordance with ASTM C127.

b. Admixtures:

1) Pumping Aids: As required to produce pumpable mix with sufficient strength.
2) Accelerators: Do not use with pumped concrete.

D. Concrete shrinkage test:

1. Before placing any concrete slabs or exposed concrete above grade, prepare a trial batch of the mix design, using the same aggregates, cement and admixtures (if any) proposed for use on the Project. Prepare at least 3 specimens for determining the "drying shrinkage" of each mix design including structural semi-lightweight concrete.

2. The "drying shrinkage" specimens shall be 4" x 4" x 11" prisms, made, cured, dried and measured as specified in ASTM C 157. Measure and report separately for 7, 14, 21 and 28 days of drying, after 7 days of moist curing. The effective gauge length of the specimens shall be 10".
3. The average "drying shrinkage" of the test specimens after 28 days of drying shall not exceed 0.0045%.

E. Submit reports showing results of sieve analysis, mix design and results of compression tests.

1. Make test specimens from not less than 3 batches of each design mix.
2. The trial batch strength for each mix shall exceed indicated f'c by 25% or a lesser amount based on standard deviations of strength test records according to ACI 318.
3. Do not start concrete production until mixes have been reviewed and are acceptable to the Architect.

F. Concrete mixing:

1. Mixing and delivery shall comply with ASTM C 94, these Specifications, and Building Code requirements.
2. The Owner's Testing Agency will perform check sieve analysis of the aggregates being used, check compliance with mix design and the cement being used against mix design; check that water has been removed from the drum before adding mix ingredients for the following load and shall witness the loading of mixing trucks. The Owner's Testing Agency will send a written report of each inspection to Architect indicating compliance with these Specifications.
3. In addition to the requirements of ASTM C 94 section 16.1, provide the following information on delivery tickets signed by an authorized representative of the batching plant with each mixer truck of concrete delivered to the site.

    a. Type and brand of cement.
    b. Cement content per cu. yd. of concrete.
    c. Maximum size of aggregate.
    d. Total water content expressed as water/cement ratio.
    e. Time batched.

4. Deliver batch tickets to Inspector at the site when concrete is delivered.
5. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.
6. Remove all materials, including water remaining in the ready-mix truck drum, completely before ingredients for the following loads are introduced in the drum.
7. Do not use concrete that has not been placed 30 minutes after leaving the mixer, or concrete that is not placed within 60 minutes after water is introduced into the mix.

2.4 VAPOR BARRIER

A. Per Division 3 Section "Vapor Barriers".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive cast in place concrete and associated work and conditions under which work will be installed. Do not proceed until satisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of the work within a particular area will be construed as Installer's acceptance of surface conditions.

3.2 GENERAL

A. Applicable provisions of the following American Concrete Institute publications govern the work of this Section.

1. ACI 301, Specifications for Structural Concrete for Buildings.
2. ACI 302, Guide for Concrete Floor and Slab Construction.
3. ACI 304, Guide for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 304.2, Placing Concrete by Pumping Methods.
5. ACI 305, Hot Weather Concreting.
6. ACI 306, Cold Weather Concreting.
7. ACI 308, Standard Practice for Curing Concrete.
8. ACI 117, Concrete Tolerances

3.3 PHASING

A. Allow sufficient time in the construction schedule for appropriate slab drying, in accordance with the finish manufacturer's recommendations, for slabs to receive a deferred finish that is moisture sensitive.

3.4 PREPARATION

A. Inspect excavations, subgrades and formwork, as applicable for each placing operation, for accuracy of lines, levels, elevations and dimensions.

B. Inspect placement of reinforcement and accessories for proper position, sizes, clearances, fastenings, laps and splices.

C. Moisten, do not saturate, earth subgrade and bearing surfaces. Do not place concrete on muddy subgrade.

D. Wet wood forms thoroughly when they are not treated with form release agent. Wet other materials sufficiently to reduce suction and maintain concrete workability.

E. Grade sand covering the vapor barrier to provide a layer of uniform thickness. Wet so that concrete is placed on damp sand.

F. Verify that steel decking joints are sealed and that there are no openings or voids that will permit concrete leakage.

G. Place items to be embedded in concrete, including but not limited to, conduits, sleeves, nailers, anchors and rough hardware, built into concrete as indicated or required.

1. Do not embed piping and conduits unless approved by the Architect, and as indicated on the Drawings.
2. Embed bolts, inserts and other items in the concrete. Secure accurately so that they are not displaced during concrete placing, compacting and finishing operations. Wire tie, nail or bolt embeds securely to forms.
3. Set embedded bolts for materials and equipment attached to concrete to template, layouts and shop drawings. Verify size, length and location of electrical conduits with respect to equipment supports.
4. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete in the voids.
5. Install expansion joint fillers where indicated, and as required to isolate concrete slabs-on-grade from other building elements such as walls and equipment pads. Cover filler with plastic joint cap and leave in place until ready to receive sealant.
6. Install the water stop in all construction joints below grade, and elsewhere as indicated.

    a. Place water stop in a continuous ribbon on the exterior face of the outermost dowel line. Keep a concrete cover of 2 inches, minimum.
    b. When using Waterstop-Rx, butt ends of water stop and nail to concrete to avoid displacement during concrete placing and consolidation.

H. Do not proceed with placement of concrete until all conditions are satisfactory.

I. Install vapor barrier where called for on the drawings under interior slabs on grade. Lap joints minimum 6 inches and seal. Do not disturb or damage vapor barrier while placing concrete. Repair damaged vapor barrier.

3.5 CONVEYING

A. Rapid handling: Transport concrete from the mixer to location of placing as rapidly as practical to avoid separation or loss of ingredients.

B. Transporting methods: Use pipes, cranes, carts, buggies or other approved means to deliver concrete to final locations. Do not use delivery systems (pipe, chutes, etc.) formed of aluminum for transporting concrete.

C. Free fall:

1. As dictated by job conditions at each location, but not more than 4 ft. where concrete will be exposed in the work and 6 ft. at all other locations.
2. Avoid large concentration of concrete in one location that would produce unacceptable deflection in supporting formwork or steel decking.

D. Concrete flow:

1. Keep surface of concrete level during placing with a minimum of concrete allowed to flow from one position to another.
2. Carry concrete up uniformly for the length of walls being placed to reduce lateral flow of concrete to 5 feet, maximum.

E. Runways: Construct substantial runways and scaffolding to avoid movement and vibration in the forms and reinforcing steel as a result of transporting and placing concrete.

3.6 PLACING

A. General: Comply with ACI 304. Do not place concrete in or under water.

B. Consolidation: Thoroughly consolidate concrete and work it around reinforcement and embedded items and into corners and angles of forms, by spading, rodding and tamping to exclude rock pockets, air bubbles and "honeycombs" and to obtain required density and strength.

C. Internal vibration:

1. Use mechanical vibrators to consolidate each layer with that previously placed, to completely embed reinforcement and fixtures, and to bring fine materials to the faces and top surfaces to produce the proper finish.
2. Assign at least one workman at each location where concrete is being placed to vibrate and consolidate the concrete in forms. Take care to avoid over-vibration causing separation of ingredients. Keep extra standby vibrator at the site.
3. Do not use vibrator to move concrete.

D. Flow of concrete:

1. Keep surface of concrete level during placing, with a minimum of concrete allowed to flow from one position to another.
2. Place concrete in a continuous operation until each section or panel has been completed.

E. Record: Keep records showing location, date and time of placement and quantity of all concrete placed on the Project.

F. Floor slabs: Shape slabs to the levels, slopes and elevations indicated and accurately pitch or grade to drainage fittings and fixtures installed in them. Where indicated, depress slabs to receive other finishes.

G. Wall supported elements:

1. Under normal weather conditions, wait at least 2 hours after depositing concrete in walls and columns before placing concrete in supported floors.
2. Consider beams, girders, capitals and brackets as part of the floor systems.

H. Temperature: Do not place concrete when the temperatures of the materials in contact with the concrete, the concrete temperature, and the ambient temperature exceed the ranges recommended in ACI 305 and 306, or if it is likely to exceed these temperature before the concrete has taken its initial set, unless special precautions recommended by ACI 305 and 306 are provided.

I. Construction joints:

1. Location: Locate joints to least impair the strength and appearance of the structure. Obtain the Architect's approval of all construction joint locations before casting concrete. In general construction joints shall be located as follows, unless otherwise indicated on the Drawings:

    a. In walls locate at the underside of floors or slabs, and at the top of footings or floor slabs.
    b. In slabs-on-grade locate joints where shown on the Drawings; offset not less than 5 feet, with a minimum of 2 offsets. Allow proper time lapse in placing of floor sections adjoining prior placings.
    c. In all cases make construction joints perpendicular to the main reinforcement. Continue reinforcement across joints, unless otherwise indicated.

2. Provide keyways at least 1-1/2 inches deep in construction joints in slabs, and between walls and footings etc. without exception; use prefabricated bulkheads for slabs.
3. Keep exposed face of construction joints continuously moist from time of initial set until subsequent placing of concrete against them, but not to exceed the curing period. When not damp, wet (do not saturate) the contact surface of joints for a minimum of 24 hours before placing adjoining concrete.

    a. Before placing adjoining concrete, clean contact surfaces to remove all laitance, loosened particles of aggregate or damaged concrete, and expose sound, coarse aggregates solidly embedded in the matrix.
    b. To achieve the above, the contact surface may be washed with clean water under pressure (jet blast), may be sandblasted, or in areas which will be concealed from view when the building is completed an approved structural adhesive may be used on clean, structurally sound concrete. Remove wash water entirely from surface.
    c. If a contact surface becomes coated with foreign materials of any nature after being cleaned, clean again to suitable condition.

J. Tolerances: In compliance with ACI 117 with the following clarifications and as specified by the Architect for exposed concrete surfaces.

1. Paragraph 4.5.4, Class A (1/8 in.) for offset in formwork.
2. Paragraph 4.5.7, "Flat" 3/16 in. in 10 ft. for slabs.
3. Unless more stringent requirements are specified for architecturally exposed surfaces provide concrete placement and finish as required to achieve tolerances as follows:

    a. Slab on grade: FF=35, FL=25, with minimum local values FF=20, FL=15
    b. Slab on metal deck: 3/16in. in 10ft.

3.7 FINISHING

A. Formed concrete surfaces:

1. General:

    a. Remove fins, laitance and loose materials from concrete surfaces when forms are removed.

b. Repair honeycombs, rock pockets, sand runs, spalls and other damaged surfaces by removing the damaged or unsatisfactory area to sound concrete, with slightly undercut edges, and filling-in with the same mix as the adjacent concrete minus the coarse aggregate. All proposed repair procedures shall be mocked up and approved by the Architect prior to field application.
c. Fill-in tie holes with the same mix as the adjacent concrete minus the coarse aggregate.
d. Tamp and float, or trowel patches flush with adjacent surface and to match adjacent concrete texture.

2. Exposed walls: Patch as specified above, rub with carborundum stones, fill imperfections with a cement paste, then sack and rub to produce uniformly smooth surfaces.
3. Related unformed surfaces: Strike top of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, after concrete is placed, and float to a texture reasonably consistent with that of adjacent formed surfaces. Continue final treatment on formed surfaces uniformly across unformed surfaces.

B. Top of grade beams, footings and pile caps: Screed to elevations indicated.

C. Slabs:

1. Protection:

a. Protect work of other trades from damage by covering it with heavy kraft paper securely taped in place. Leave protection in place as long as its need exists.
b. Control the use of water and other contaminants within the building so that no damage to previously installed work or existing structure and finish occurs.

2. Compacting and floating:

a. Bring slabs to proper elevations and strike off with a straightedge. Remove excess water and laitance.
b. Compact and consolidate to embed coarse aggregates.
c. Float and test surfaces with a 10 ft. straightedge and eliminate high and low spots to comply with tolerances specified.
d. From this point, use the methods and tools necessary to produce surface tolerances and finishes specified.
e. Use screeds of type and spacing required to produce specified slab tolerances.

D. Screeding: At concrete for floors to be placed over steel deck.

1. The steel angle closure at metal deck edges is not intended to serve as a screed.
2. Use adjustable screeds at all screeded points and adjust to compensate for existing deflection and for deflection of deck and beams occurring during concreting operations.
3. Continuously monitor screeds and floors during concrete placement and finishing and adjust concrete floor thickness as required to obtain level floors.

E. Moisture control: In addition to other finishing requirements, use a water fog spray to reduce plastic shrinkage cracks during flatwork finishing operations when conditions of low humidity and/or high temperature exist.

1. Immediately after concrete has been brought to a flat surface and the shiny film of moisture disappears, restore it and maintain until final troweling by applying a light film of moisture with an atomizing type fog sprayer.
2. Use frequent light applications of moisture rather than excessive amounts at any one time. Adjust the amount and frequency of fog spray as required by variable conditions of weather, wind, temperature and humidity.

F. General requirements:

1. Finish surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.
2. Where concrete finishing occurs adjacent to finished metal and similar surfaces, particularly where serrated or indented surfaces occur, remove all traces of cement film before allowing concrete to harden.

G. Schedule of finishes:

1. Scratch (or raked) finish:

    a. Apply to monolithic slabs to receive adhered and bonded concrete floor topping, mortar setting beds for tile and stone paving, and other cementitious finish flooring material.
    b. After placing slabs, plane the surface to a tolerance not exceeding 1/4 in. in 2 ft. when tested with a 2 ft. straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen the surface before the final set with stiff brushes, brooms or rakes.

2. Float all other monolithic slab surfaces unless otherwise specified.

    a. After placing concrete slabs, do not work the surface further until ready for floating.
    b. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of power-driven float, or both.
    c. Consolidate the surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.
    d. Float surfaces to receive roofing and bituminous waterproofing to produce a uniform texture and finish throughout acceptable to the roofing and waterproofing subcontractors.

3. Steel trowel surfaces to receive elastomeric coating, ceramic tile, carpeting, resilient flooring, other thin floor coverings, and concrete slabs which have no other specified finish, to a hard, dense, burnished surface.

    a. Consolidate the concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface plane tolerance specified. Grind smooth surface defects that would telegraph through applied floor covering system.
    b. After steel troweling, texture surfaces to be tiled and slabs to receive elastomeric coating with a fiber broom to provide a mechanical bond with the mortar, or omit the burnishing. These slabs must be approved by the subcontractors installing the tiles and the elastomeric coatings as satisfactory to receive their work.

4. Finish walk slabs with a medium broom finish, with tooled edges, as approved by the Architect on a 4 ft. square sample panel to be provided by the Contractor where directed at the site. Draw broom against a straightedge at right angle to the direction of traffic.

H. Markings:

1. At expansion joints and elsewhere as indicated, mark slabs with a 1/4 in. radiused edging or marking tool. In textured work edge and mark slabs, after texturing, with a combination edging/smoothing tool approximately 1-1/2 in. wide.
2. Where saw cutting is indicated, time this operation so that it is performed as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by the saw, but before shrinkage stresses have developed sufficiently to produce cracking.
3. Make marking lines straight, or curved as indicated, equally spaced and parallel to adjacent lines and/or walls, edges and other construction, and of uniform depth and cross section, with intersections accurately formed.

I. Curbs: Immediately after removing forms, finish faces and top with a steel trowel.

3.8 CURING

A. Formed concrete:

1. Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.
2. If forms are removed before 14 days after concrete is cast, coat concrete with curing compound as specified for flatwork below.

B. Concrete flatwork:

1. After finishing, spray the specified curing compound uniformly in a minimum of 2 coats at 90 degrees to each other at 3 times the minimum coverage rates recommended by the manufacturer.

    a. Inspect treated surfaces daily for 14 days for evidence of drying.
    b. Re-wet the surfaces and apply a new application of curing compound, if premature drying occurs, as soon as can be done after finishing without marring the surfaces.

2. All interior floors not scheduled to receive a deferred finish shall receive the sealer applied in compliance with its manufacturer's printed instructions. Remove sealer residue after curing period is completed.
3. Concrete for the fountain and waterfall structure should be only water cured.

3.9 MISCELLANEOUS CONCRETE WORK

A. Provide all other concrete work indicated or required to complete the Work, even though not specifically specified, including the following.

B. Grouting and dry-packing: Comply with the grout manufacturer printed instructions and the following.

1. Mix material with sufficient water so it flows under its own weight for grout, and to just moisten and bind the material together for dry-pack.
2. Place dry-pack by forcing and rodding to fill all voids and provide complete bearing under plates. Place fluid grout from one side only and puddle to completely fill voids; do not remove dams or forms until grout attains initial set. Finish exposed surfaces smooth and damp cure at least 3 days.

C. Equipment bases and foundations:

1. Provide machine, and equipment bases and foundations where indicated on Drawings.
2. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of the manufacturer furnishing the machines and equipment.

D. Pits, trenches, curbs, integrally-cast equipment pads and other miscellaneous concrete work: Construct to the profiles and dimensions indicated.

E. Waterproof membranes:

1. Perform work over waterproof membranes to prevent damage to the membranes.
2. Schedule this work to reduce to a practical minimum the period when the installed membrane is left without protection.
3. Prior to placing concrete, inspect the membrane and repair damage that may have occurred.

3.10 PROTECTING/CLEANING

A. Take suitable precautions in compliance with applicable ACI requirements to secure satisfactory concrete in either hot or cold weather.

B. Restrict construction vehicular traffic on slabs-on-grade to prevent damage and staining.

C. Protect concrete to prevent damage and staining.

D. Protect work of other trades from damage by work of this Section with heavy kraft paper securely taped in place.

E. Upon completion, wash and clean exposed concrete and leave free of oil, paint, plaster and foreign substances, ready to receive applied finishes or to be left exposed.

3.11 DEFECTIVE CONCRETE

A. Concrete which does not meet the requirements of the Contract Documents will be deemed defective.

B. Remove defective concrete as directed by Architect and replace with concrete meeting the requirements of the Contract Documents, at no additional cost to the Owner.

3.12 FIELD QUALITY CONTROL

A. Concrete quality control: The following will be performed by the Owner's Testing Agency.

1. Samples will be taken during progress of the work to determine slump, compression strength, aggregate sieve analysis, and grout-mix tests, with assistance furnished by the Contractor.
2. 4 cylinders will be made for each day's pour or for each 100 cu. yds. or once for each 4,000 sq. ft. of surface area, whichever is less, for each type of concrete being cast.
3. 1 cylinder will be tested at 7 days, and 2 cylinders at 28 days. The remaining cylinder will be kept in reserve in case tests are unsatisfactory.
4. Samples will be made in compliance with ASTM C 172.
5. Specimens will be made and laboratory cured in compliance with ASTM C 31.
6. The 28-day values will be the criteria for acceptance of concrete regarding strength only.

    a. 7-day tests may be regarded as indicative of compliance or non-compliance with the 28-day strength requirements, and the Contractor should be guided accordingly in matter of adjusting proportions, if necessary, and notify the Architect.
    b. 7-day tests shall also be a guide to the Contractor regarding time for form removal.

7. Slump tests will be made for each set of tests cylinders in compliance with ASTM C 143.

B. Tests evaluation:

1. Concrete cylinder test will be evaluated in compliance with ACI 214 and 318.
2. If 28-day test results indicate that concrete strength is not as specified, core concrete as directed by the Architect in compliance with ASTM C 42.
3. In the event that additional core tests do not show strength required, or as determined by load tests made in compliance with ACI 318, the defective concrete shall be removed and replaced, or shall be reinforced as directed by the Architect, at the Contractor's expense.
4. If core tests results fall below design strength specified, adjust the concrete mix or water content for future batches, at no additional cost to the Owner.

C. Concrete floors shall be tested for flatness & levelness per ACI 117 in the allotted time, by the contractor. Test results are to be sent to the architect & engineer. Floors are to be "Very Flat", U.N.O.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes polished concrete finishing.

1. CONC-02, Concrete for dyed polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.2 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Cast-in-place concrete subcontractor.
e. Polished concrete finishing Subcontractor.

2. Review curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples for Initial Selection: For each type of product requiring color selection.

D. Samples for Verification: For each type of exposed color. Provide samples with sealer and samples without sealer.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Repair materials.
2. Liquid floor treatments.

1.6 QUALITY ASSURANCE

A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.

1. Locate panels as indicated or, if not indicated, as directed by Architect.
2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
3. Demolish and remove field sample panels when directed.

B. Mockups: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build a minimum of two mockups in the location and of the size as directed by Architect, each of 50 sf. Minimum area.
2. Demonstrate curing, finishing, and protecting of polished concrete.
3. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
5. Polished concrete mockups that are not accepted may remain in place if concealed under permanent floor finish covering.

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 DYE MATERIALS

A. Penetrating Dye: Solvent based color liquid dye concentrate.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Scofield, L. M. Company; Formula One Liquid Dye Concentrate or comparable product acceptable to the Architect.

B. Chemical Hardener/Densifier: Water-borne acrylic penetrating material.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Scofield, L. M. Company; Formula One Guard-W or comparable product acceptable to the Architect.

2.2 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advanced Floor Products.
b. ARDEX GmbH.
c. Euclid Chemical Company (The); an RPM company.
d. L&M Construction Chemicals, Inc.
e. QuestMark.
f. Scofield, L. M. Company.
g. Vexcon Chemicals Inc.

PART 3 - EXECUTION

3.1 POLISHING

A. Polish: Level 2: Low sheen, 400 grit.

B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal light exposure of aggregate to match approved mockup.

a. Grind floor to within 2-3 inches of any installed walls with multiple passes of finer-grit pads to indicated level of grit finish, removing construction debris, floor slab imperfections and until there is a uniform scratch pattern and desired concrete aggregate exposure.

2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

3.2 DYING

A. Newly placed concrete shall be at least 14 days old before staining.

B. Prepare surfaces according to manufacturer's written instructions and as follows:

1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding or sanding. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
3. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between 7 and 8.

C. Allow concrete surface to dry before applying dye. Verify readiness of concrete to receive dye according to ASTM D 4263 by tightly taping 18-by-18-inch, 4-mil- thick polyethylene sheet to a representative area of concrete surface. Apply dye only if no evidence of moisture has accumulated under sheet after 16 hours.

D. Penetrating Dye: Apply penetrating dye and densifier to concrete surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 033713 - SHOTCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work includes:

1. Shotcrete at indicated locations. Shotcrete shall be as specified herein, and as needed for a complete and proper installation.

B. Related work includes:

1. Concrete formwork including any required formwork for shotcrete: Section 031000.
2. Concrete reinforcement, including reinforcement for shotcrete: Section 032000.
3. Cast-in-place concrete: Section 033000.

C. Related work provided by Owner:

1. Registered Deputy Inspector to inspect the placement of all shotcrete in accordance with Building Code requirements.

1.2 TESTS AND INSPECTIONS

A. General:

1. The Owner will employ a Testing Agency to test and inspect this work as specified here after, and to submit reports to all concerned parties.
2. The Testing Agency will be responsible for conducting and interpreting the tests and inspections, will state in their reports whether the results comply with the Contract Documents and requirements of Governing Authorities, will specifically note deviations there from, and will indicate corrective measures required and taken.
3. The Contractor shall make corrective measures, including additional and more complete testing if initial testing indicates non-compliance with the Contract Documents and requirements of Governing Authorities, at no additional cost to the Owner.
4. Cooperate with the Testing Agency's personnel and permit their unrestricted access to the site as required for the performance of their duties.
5. Refer to Section 014000 - "Quality Control" for additional information pertaining to tests and inspections.

B. The Testing Agency employed by the Owner will:

1. Test the proposed materials for compliance with these specifications.
2. Review and check proposed mix proportions.
3. Test preconstruction test specimens.
4. Secure production samples of materials at stockpiles during construction and test for compliance with specifications.
5. Test the strength of the shotcrete as the work progresses by one or more of the following methods:

a. Cut cores from the structure and test in accordance with ASTM C42. A set of 3 cores will be taken not less than once each shift nor less than once for each 50 cu/yd of shotcrete placed through the nozzle. Cores will be soaked in water for a minimum of 40 hours before testing.
b. Make one test panel as indicated on the Drawings, gunned in the same position as the work represented. Panels shall be gunned during the course of the work by the Contractor's regular nozzle operator. Field cure panels in the same manner as the work, except that the test specimens shall be soaked in water for a minimum of 40 hours before testing. The designated testing agency will cut cores as indicated on the Drawings.
c. When the length of a sample is less than twice the diameter, apply the correction factors given in ASTM C42 to obtain the compressive strength of individual cores.

6. The average compressive strength of three samples taken from the structure or test panel, representing a shift or 50 cu/yd of shotcrete, must equal or exceed 0.85 fc with no individual core less than 0.75 fc. The average of three cubes taken from a panel representing a shift or 50 cu/yd of shotcrete must equal or exceed fc with no individual cube less than 0.88 fc.
7. Final acceptance of the shotcrete will be based on results obtained from samples or sawed cubes. Use of data obtained from impact hammers, ultrasonic equipment, or other nondestructive testing devices will not be permitted for final acceptance of the shotcrete. However, these data may be useful for determining uniformity of the shotcrete.

C. Preconstruction testing to be performed by the Contractor: The Contractor shall prepare specimens for examination and testing prior to construction.

1. Contractor shall have test specimens made by each application crew using the equipment, materials, and mix proportions proposed for the Project.
2. Contractor shall make a test panel at least 30" x 30" for each mix being considered, and for each shooting position to be encountered in the job. Provide the same reinforcement as the structure in at least half of the panel to test for proper embedment of reinforcing steel. Fabricate test panels to the same thickness as the structure, but not less than 3". Take at least 5 cubes or cores from the panels for testing. All cut or broken surfaces shall be dense and free from laminations and sand pockets. Finish test panel with smooth sponge float finish texture as directed by Architect.

a. If first texture test panel is unacceptable, construct additional one(s) until Architect's acceptance is gained.

3. Alternate to preconstruction testing: When accepted by the Architect, preconstruction testing may be eliminated if it has been shown that mix, materials, equipment, and personnel have given satisfactory results on similar work. In such case, make test panels concurrently with the first shotcrete placed on the site.

1.3 QUALITY ASSURANCE

A. Use adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. In addition to complying with pertinent regulations of governmental agencies having jurisdiction, comply with pertinent provisions of ACI 506. "Recommended Practice for Shotcreting", and ACI 506.2. "Specifications for Materials, Proportioning, and Application of Shotcrete", except as may be modified herein.

C. Do not commence placement of shotcrete until required mix designs joint layout, curing method, pumping Operations sequences and procedures have been reviewed and approved by the Deputy Inspector and all governmental agencies having jurisdiction.

D. Refer to the Structural General Notes on the Drawings for additional requirements pertaining to this work. Applicable parts of Structural General Notes shall apply to the work of this Section as though repeated verbatim herein.

1.4 SUBMITTALS

A. Make submittals in accordance with the requirements of Section 013300.

B. Data: Submit shotcrete mix design, curing method, joint layout, pumping operation sequence and procedures.

C. Phasing of shotcrete Work: Submit proposed plan for phasing the shotcrete work.

1.5 HANDLING

A. Comply with requirements of Section 016500.

1.6 PROTECTION

A. Finished shotcrete concrete surfaces shall be protected from stains, abrasions and other damage, as necessary.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: Use the type of Portland cement upon which the approved mix design is based.

B. Cement Tests. Required prior to use for all cement needed for shotcrete applied concrete.

1. Tensile strength required at 7 days only by ASTM C183, C184, C187, C190 and C191 methods.
2. Resample and retest any cement showing evidence of damage or deterioration prior to testing, prior to use.
3. Certificate required, acceptable evidence and information required on the Certificate Test verifications as prescribed by the Los Angeles County Building Code.

4. Alternate: Perform sampling and testing after delivery to the jobsite. Do not use cement until results of tests are known.

C. Aggregates: Provide normal weight aggregate complying with ASTM C33, with the combined gradation of fine and coarse aggregate conforming to Table 2.2.1 of ACI 506.2 and as recommended in the approved mix design where mix designs are required to be submitted.

D. Water: Clean, fresh, and potable.

E. Admixtures: Use only those admixtures recommended in the approved mix design and approved by the governmental agencies having jurisdiction.

2.2 SHOTCRETE MIX DESIGNS

A. Owner's Testing Agency using a Registered Engineer shall provide a mix design and curing method, based on strength of the specified materials, and meeting the requirements stated in the Contract Documents.

1. Owner's Testing Agency shall submit each mix design to the Architect, including new mix designs required to be prepared should there occur a change in materials being used.
2. Comply with provisions of Paragraph 2.5 of ACI 506.2.

B. Produce the compressive strengths called for on the Drawings.

C. Mix cement and aggregates dry in a suitable mixer for not less than one minute but not until all ingredients are thoroughly mixed. Discharge mixer completely before recharging.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until detrimental conditions are corrected.

B. Inspect forms and reinforcement after placement of reinforcing and prior to placing shotcrete.

3.2 BATCHING AND MIXING

A. Control mix proportions by weight batching, or by volume batching complying with ASTM C685.

1. If permitted, other volume batching procedures may be used, provided a minimum of one weight batching check is made every four hours for control purposes.
2. Assure that the specified mix design is achieved.

B. Use batching and mixing equipment capable of proportioning and mixing all ingredients (except water in the case of dry-mix equipment) at a rate that will provide adequate production and with an accuracy that will assure uniformity of batches.

1. Use weighing equipment capable of batching with the accuracy specified In ASTM C94.
2. For volumetric equipment, be capable of batching with the accuracy specified in ASTM C685.

C. Ready-Mixed Concrete (if used):

1. Comply with ASTM C94; except the materials may be delivered to the shotcrete equipment in the dry state if that equipment is capable of adding the water and mixing it satisfactorily with the dry ingredients: or
2. Comply with ASTM C685 in which case deliver the ingredients dry and proportioned, and mix at the jobsite.

3.3 PREPARATION OF SURFACES

A. Steel Surfaces:

1. Remove rust, oil, scale, and previously applied paint from surfaces receiving shotcrete.
2. Comply with Specification SSPC-SP6 of the Steel Structures Painting Council.

B. Forms

1. Use form-coating material on removable forms to prevent absorption of moisture and to prevent bond with the shotcrete.
2. Use a non-stain material for surfaces exposed to view when construction is completed.
3. Do not use form-coating material that will interfere with subsequent bonding to the shotcrete when such bonding is required.

3.4 PLACEMENT OF SHOTCRETE

A. Place shotcrete using suitable delivery equipment and procedures that will result meeting the specified requirements. Keep a copy of ACI 506 on hand at the site for easy reference while this work is being done. Substitute the word "shall" whenever the word "should" occurs in ACI 506.

B. Placement Thicknesses:

1. Control thickness, method of support, air pressure, and/or water content of shotcrete to preclude sagging and sloughing off.
2. Discontinue shotcreting, or provide suitable means to screen the nozzle stream, if wind or air currents cause separation of the nozzle stream during placement.

3. Dampen absorptive substrate surfaces prior to placement of shotcrete to facilitate bond and to reduce the possibility of shrinkage cracking developing from premature loss of water.
4. Broom or scarify the surface of freshly placed shotcrete to which, after hardening, additional layers of shotcrete are to be bonded. Dampen surface just prior to application of succeeding layers.
5. First, fill with sound material all corners and areas where rebound cannot escape or be blown free. Complete the corners between the web and flanges of structural steel before application to the flat areas.
6. Provide a supply of clean, dry air adequate for maintaining sufficient nozzle velocity for all parts of the work and, if required, for simultaneous operation of a suitable blow pipe for clearing away rebound.
7. Provide a capable nozzle operator's helper equipped with an air blowpipe to assist the nozzle operator in keeping all rebound build-up out of the finished work. Additional workers may be required to take the rebound from the work if rebound cannot be removed by the air blow pipe.
8. The height of a layer shall be limited to a maximum of 3', and a succeeding layer shall be placed in less than 3 hours, unless preconstruction test panel indicates these values may be exceeded. No sloughing or sagging will be permitted.

C. Placement Around Reinforcement:

1. Hold the nozzle at such distance and angle to place material behind reinforcement Before any material is allowed to accumulate on its face.
2. In the dry-mix process, additional water may be added to the mix when encasing reinforcement, to facilitate a smooth flow of material behind the bars.
3. Do not place shotcrete through more than one layer of reinforcing steel rods or mesh in one application, unless demonstrated by preconstruction tests that steel becomes encased properly.
4. Test to ascertain if any voids or sand pockets have developed around or behind reinforcement by probing with an awl or other pointed tool after the shotcrete has achieved its initial set; by removal of randomly selected bars: or by coring or other suitable means. Cost of test cores shall be paid for by the Contractor.

D. Cover of Reinforcement: Place shotcrete to provide the following minimum cover over reinforcement.

1. For Reinforcement in Slabs and Walls: 3/4" for fine aggregate shotcrete and 1-1/2" for coarse aggregate shotcrete, 2" for surfaces exposed to earth or weather.
2. Do not decrease the above minimums except as specifically approved in writing by Architect.

E. Line and thickness Control:

1. Use adequate ground wires or other accepted means to establish the thickness, surface planes, and finish lines of the shotcrete.
2. Maintain specified tolerances by keeping ground wires secure and taut.

F. Placement Precautions:

1. Do not place shotcrete if drying or stiffening of the mix takes place at any time prior to delivery to the nozzle.

2. Do not use rebound or previously expended material in the shotcrete mix.
3. Remove all overspray and rebound prior to final set and before placement of shotcrete material on such adjacent surfaces.

3.5 REPAIR OF SURFACE DEFECTS

A. Remove shotcrete which lacks uniformity, exhibits segregation, honeycombing, or lamination, or which contains any dry patches, slugs, voids, or sand pockets.

B. Repair defective areas by preparing as specified above for existing concrete and masonry surfaces, and by applying new shotcrete meeting the specified requirements.

1. Repair core holes in accordance with Chapter 9 of ACI 301.
2. Do not fill core holes with shotcrete.

3.6 FINISHING

A. Where exposed in the finished work: Apply a smooth sponge float finish, as required to match the approved sample to exposed shotcrete surfaces.

B. Where concealed in the finished work: Apply a smooth wood float finish.

C. In other finishing operations, avoid troweling of thin sections of shotcrete unless both troweling and commencement of moisture curing take place within a relatively short period after placement of shotcrete.

D. Do not, in any case, scrape or cut to remove high spots until the shotcrete has become stiff enough to withstand pull of the cutting devices.

3.7 JOINTS

A. Make joints in accordance with Paragraph 3.6 of ACI 506 2, as approved by the Architect, and in compliance with pertinent requirements of governmental agencies having jurisdiction.

3.8 CURING AND PROTECTION

A. Cure and protect the in-place shotcrete with approved chemical curing compound in accordance with pertinent provisions of Paragraph 3.7 of ACI 506.2, except as may be directed otherwise by the Architect.

B. If forms are removed during the curing period, proceed as specified previously. If forms remain in place, keep them continuously wet for the period of time specified above.

C. Prevent rapid drying at the end of the drying period.

3.9 CLEANING AND CLEAN-UP

A. Remove all rebound materials, other excess, forms, reinforcing, send and cement materials, tools and equipment from the jobsite and leave all work areas in a clean and safe condition.

B. Contractor to clean adjacent surfaces of building of splashed-on shotcrete placed concrete materials by approved methods.

END OF SECTION 033713

SECTION 035300 - CONCRETE TOPPING

1.1 QUALITY ASSURANCE

A. Mockups for concrete floor toppings.

1.2 SUSTAINABILITY REQUIREMENTS

A. LEED 2009 NC:

1. Low-emitting flooring.

1.3 MATERIALS

A. Topping: A concrete resurfacing compound modified with high-performance polymers for exceptional bond strength, suitable for polishing.

1. Compressive Strength (28 Days): 6,500 psi.

B. Divider Strips: 1/4 inch wide metal divider strips and transitions.

1.4 INSTALLATION

A. Concrete Floor Topping Application: Epoxy-bonding adhesive applied to existing concrete; hard trowel finish.

1.5 FIELD QUALITY CONTROL

A. Testing: By Owner-engaged agency.

END OF SECTION 035300

SECTION 035416 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.3 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For coatings, indicating VOC content.

B. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

PART 2 - PRODUCTS

2.1 HYDRAULIC CEMENT UNDERLAYMENTS

A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch (6 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Ardex; K-15 Self-Leveling Underlayment Concrete.
    b. BASF Construction Chemicals, Inc.; Chemrex Self-Leveling Underlayment.
    c. Bonsal American, an Oldcastle company; ProSpec Level Set 300.
    d. Dayton Superior Corporation; LeveLayer.
    e. MAPEI Corporation; Novoplan 2.

2. Cement Binder: ASTM C 150/C 150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 6000 psi at 28 days when tested according to ASTM C 109/C 109M.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

1. VOC Content: Provide coating with VOC content of 200 g/L or less.

E. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Apply surface sealer at rate recommended by manufacturer.

G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION

SECTION 036300 - CONCRETE EPOXY ADHESIVE INJECTION

PART 1 - GENERAL

1.1 SCOPE

A. For Cracks up to 1/4".

1. Requirements of the general conditions, supplementary general conditions and division 1 apply to work of this section.
2. Furnish all labor, materials, services equipment and appliance required to perform all work to complete the contract, including but not limited to, these major items:
3. Injection of concrete members with liquid epoxy adhesive in walls and architectural concrete members. Cracks that are at least .030 inches wide are to be epoxied.
4. All work shall conform to current standards for historical restoration.

B. RELATED WORK

1. Tests and inspections.
2. Repair of concrete and concrete finishes.

1.2 QUALITY ASSURANCE

A. Manufacturer qualifications: Provide epoxy injection system, which is the product of a manufacturer whose complete system has been approved by the architect. The manufacturer shall have a system that has been used for epoxy injection projects similar in nature for a minimum of fifteen (15) years. Pay all fees and obtain approval for material prior to commencing work.

B. Sub-contractor qualifications: The epoxy injection sub-contractor will have successfully performed previous installations similar in nature to the one involved in this contract. The epoxy injection sub-contractor shall have a minimum of the (5) years experience with epoxy injection work and shall be a trained and recommended applicator of the epoxy injection material manufacturer.

C. Qualifications of epoxy injection field superintendent: All work in the field shall be performed under the immediate control of a foreman or superintendent experienced in this type of work. This person shall exercise close check and rigid control of all operations as necessary for full compliance with all requirements.

D. Worker's qualifications: Contractors/Subcontractors workers in the epoxy injection process shall have completed a program of instruction in the methods of restoring concrete structures, utilizing the specific epoxy injection process indicated. The curriculum shall include theory in the nature and causes of cracking in concrete, methods of permanently repairing damaged concrete structures, he technical aspects of correct material selection and use, and the operation, maintenance and trouble shooting of equipment.

1.3 TESTING AND INSPECTION

A. Material Tests: Owner's testing laboratory will provide all material tests as required by architect and as specified herein. Owner will pay for any costs of testing.

B. Inspections: If necessary, owner will arrange and pay for the services of registered deputy building inspector for continuous inspections of all epoxy injection work. Inspector will be continuously present during the epoxy injection operations, and will make written reports to engineer, and certifications to architect as to compliance with building code requirements and contract drawings and specifications.

C. Field Quality Control:

1. Core Testing to verify penetration and strength. (Note: It is imperative that no rebar or tendons be cut. It may be necessary to use a pachometer to locate existing reinforcing).
2. Initial Cores: The contractors/subcontractor shall obtain one (1) 2" diameter initial core sample for each 100 lineal foot of crack repaired or as directed by the architect.
3. The cores shall be adequate in diameter to intersect the crack to the full depth of core and taken from locations as directed by the architect.

D. Methods of Testing Initial Cores:

1. Penetration: Visual Examination.
2. Bond Strength Compression Test: ASTM C 39.

E. Test Requirements:

1. Penetration: A minimum of 90 percent of the crack shall be full of epoxy adhesive.
2. Bond Strength/Compression Test: concrete failure before adhesive failure, or 5,000 PSI with no failure either concrete or adhesive.
3. Evaluation and Acceptance of Tests: If the initial cores conform to the requirements of C.2 "Penetration" and "Bond Strength", epoxy adhesive injection work at the area represented by the cores shall be accepted.
4. If the initial cores do not conform to the requirements of C.2 "Penetration" above, the work shall not proceed further until the area represented by the cores is re-injected and retested for acceptance.
5. After rework of areas represented by failed initial cores is complete, the contractor shall obtain verifying cores, the number and location to be determined by the engineer. Verifying cores shall be tested in accordance with paragraph C.2 and C.3 for compliance.
6. If cores do not conform to the requirements for C.2 "Bond Strength" above, the work shall be re-injected.
7. After rework of areas represented by failed cores is complete, the contractor shall obtain verifying cores, the number and location to be determined by the engineer. Verifying cores shall be tested in accordance with paragraph C.2 and C.3 for compliance.

F. Payment for core testing:

1. Testing of initial core samples which have been taken by the contractor will be performed by the owner's representative at the owner's expense.
2. Additional cores, called verification cores, required as indicated in paragraph C.4 (rework) herein, will be tested by the owner at the contractor's expense in accordance with the established fee schedule.

G. Pressure Test of Injection Equipment:

1. Method: The mixing head of the injection equipment shall be disconnected and tow adhesive component delivery lines shall be attached to the pressure check device. The pressure check device shall consist of two independent valved nozzles capable of controlling back pressure by opening or closing valve. There shall be a pressure gauge capable of sensing the pressure build up behind each valve. The valves in the pressure check device shall be closed and the equipment operated until the gauge pressure on each line reads 160. The pumps shall be stopped and the gauge pressure shall not drop below 150 PSI within 2 minutes.
2. Frequency of Pressure Test: The pressure test shall be run for each injection unit at the beginning of the shift and every four hours of use for all shifts the unit is used on the work of delaminations/crack repair.

H. Ratio Test of Injection Equipment:

1. Method: The mixing head of the injection equipment shall be disconnected and the two adhesive components shall be pumped simultaneously through the ratio check device. The ratio check device shall consist of two independent valved nozzles capable of sensing the back pressure behind each valve. The discharge pressure shall be adjusted to 160 PSI for both components. Both adhesive components shall be simultaneously discharged into separate the calibrated containers. The amounts discharged into the calibrated containers during the same time period shall be compared to determine that the volumes discharted deviate no more than 5% from the correct ratio as specified in the manufacturer's product data sheet.
2. Proof of Ratio and Pressure Testing.

I. At all Times during the course of the work the contractor shall keep complete an accurate record of the pressure and ratio tests specified above. These records shall be available to the architect. In addition, the architect/engineer, at any time without prior notification of the contractor, may request the contractor to conduct the tests specified above in the presence of the architect/engineer.

PART 2 - PRODUCTS

2.1 HIGH STRENGTH EPOXY RESIN ADHESIVE FOR INJECTION

A. Provide LARR reports for all products used for approval by architect/engineer.

B. Epoxy injection adhesive shall be Sikadur 53 as manufactured by Sika Corporation, tel (800) 933-7452, or ETI manufactured by Simpson Strong Tie, tel (562) 699-0543, or approved equal.

C. Surface Sealant: SikaTop 123 as manufactured by Sika Corporation, or ETR Epoxy Paste as manufactured by Simpson Strong Tie, or approved equal, and shall be sufficiently strong to resist injection pressures to prevent leakage during injection.

D. Provide other materials as required and recommended by manufacturers subject to approval by architect/engineer.

E. Equipment for injection type: The equipment used to meter and mix the two injection adhesive components, and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide ratio control of exact proportions of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in line metering and mixing.

F. Discharge pressure: The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set-set pressure up to + 1-5 PSI and shall be equipped with a manual pressure control override.

G. Ratio tolerance: The equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of + 1-5% by volume at any discharge pressure up to 160 PSI.

H. Automatic Shut-Off Control: The injection equipment shall be equipped with sensors on both the component A and the component B reservoirs that will automatically stop the machine when either reservoir becomes dry.

PART 3 - EXECUTION OF WORK

3.1 PREPARATION

A. Surfaces adjacent to cracks or other areas of application shall be cleaned of loose paint, dir, loose concrete, dust, grease, oil, efflorescence or other foreign matter detrimental to bond of epoxy injection surface seal. Acids and corrosives shall not be permitted for cleaning.

B. Entry ports shall be provided along the crack at intervals to allow for maximum penetration of the epoxy adhesive. Spacing of the entry ports shall be approved by the architect.

C. Surface seal material shall be applied to the face of the crack or other areas of application between entry ports as needed. For through cracks a surface seal shall be applied to both faces.

D. Enough time for the surface seal material to gain adequate strength shall pass before proceeding with the injection.

3.2 EPOXY INJECTION

A. Injection of the epoxy adhesive shall begin at an entry port at one end of the crack or at the lowest port for a vertical crack. The injection shall continue until there is an appearance of epoxy adhesive at the next port adjacent to the entry port being pumped.

B. When epoxy adhesive travel is indicated by appearance at the next adjacent port, injection shall be discontinued on the entry port being pumped, and epoxy injection shall be transferred to next adjacent port where epoxy adhesive has appeared. At the contractor's option, the injection can continue in the original port if epoxy is appearing at multiple ports adjacent to the port being pumped.

C. Epoxy adhesive injection shall continue until the cracks are completely filled.

D. If port to port travel of epoxy adhesive is not indicated, the work shall be immediately stopped and the architect notified.

3.3 FINISHING

A. When cracks are completely filed, epoxy adhesive shall be cured for sufficient time to allow removal of surface seal and ports without any draining or run-back of epoxy material from cracks.

B. Surface seal material and injection adhesive runs or spills shall be removed from concrete surfaces.

C. The surface area shall be finished flush with the adjacent concrete, showing no indications or protrusions caused by the placement of entry ports. Grind smooth as required.

D. After the work has been accepted by the owner engineer, cored holes shall be repaired using a two component bonding agent and suitable grout or patching mortar mix as acceptable to the engineer (Master Builders Construction grout or equal). The bonding agent shall be applied to the surfaces of the cored holes followed by application of the grout mix placed by hand trowel, thoroughly rodded and tamped in place, and finished to be similar in color, finish, and texture of existing concrete to the satisfaction of the owner, and ready for painting, material and procedure for filling testing core holes shall be submitted to and approved by the owner/engineer before proceeding with this work.

E. Surfaces shall be left in a "ready to paint" condition.

3.4 CLEAN UP

A. At conclusion of work remove all equipment, debris, and excess material and leave area broom clean.

END OF SECTION 036300

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Mortar and grout.
3. Reinforcing steel.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Control and expansion joints.
7. Embedded flashing.

1.3 REFERENCED STANDARDS

A. ACI - American Concrete Institute International/ASCE - American Society of Civil Engineers/TMS - The Masonry Society.

1. ACI 530.1/ASCE 6/TMS 602: Specification for Masonry Structures.

B. ASTM - American Society for Testing and Materials International.

1. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM A 641: Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
4. ASTM A 951: Specification for Masonry Joint Reinforcement.
5. ASTM B 117: Practice for Operating Salt Spray (Fog) Apparatus.
6. ASTM B 370: Specification for Copper Sheet and Strip for Building Construction.
7. ASTM C 90: Specification for Loadbearing Concrete Masonry Units.
8. ASTM C 140: Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
9. ASTM C 143: Test Method for Slump of Hydraulic Cement Concrete.
10. ASTM C 144: Specification for Aggregate for Masonry Mortar.
11. ASTM C 150: Specification for Portland Cement.
12. ASTM C 207: Specification for Hydrated Lime for Masonry Purposes.
13. ASTM C 270: Specification for Mortar for Unit Masonry.
14. ASTM C 404: Specification for Aggregates for Masonry Grout.
15. ASTM C 476: Specification for Grout for Masonry.

16. ASTM C 780: Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
17. ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
18. ASTM C 1019: Test Method for Sampling and Testing Grout.
19. ASTM C 1093: Practice for Accreditation of Testing Agencies for Unit Masonry.
20. ASTM C 1142: Standard Specification for Extended Life Mortar for Unit Masonry.
21. ASTM C 1314: Test Method for Compressive Strength of Masonry Prisms.
22. ASTM D 1056: Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

C. NCMA - National Concrete Masonry Association.

1. NCMA TEK 8-2A: Removal of Stains from Concrete Masonry Walls.

D. SMACNA - Sheet Metal and Air Conditioning Contractors.

1.4 SUBMITTALS

A. Descriptive Data: Submit descriptive data for all specified products.

B. Shop Drawings: Submit shop drawings of concrete masonry walls, including block shapes, lintel requirements, reinforcing steel, flashing, location of control and expansion joints, and sample masonry walls erected on site. Refer to Structural Drawings for additional requirements for reinforcing steel Shop Drawings. Show elevations of reinforced walls.

C. Samples: Submit three (3) samples to Architect for approval prior to fabrication. Samples to be 4 by 8 by 1 inches (102 by 203 by 25 mm).

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated.

B. Standards: Comply with ACI 530.1/ASCE 6/TMS602 (ref. 1) "Specifications for Masonry Structures":

1. "TEK" Information Series, published by NCMA.
2. Follow manufacturer's instructions for installation of each type of masonry product, unless otherwise indicated or specified.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Meeting: Before any masonry and associated work is done, Contractor to schedule pre-installation meeting at the site, attended by Owner, Architect, Contractor, Installers of Related Work, Test Agencies, Governing Authorities, and Masonry Installer. Agenda to cover field quality control program, acceptance criteria for sample wall, block pattern and jointing, flashing details, expansion joints, and cavity wall construction.

B. Record Minutes: Record discussions and agreements, and furnish copy to each participant. Provide at least 72 hours advance notice to participants prior to conference.

1.7 PROTECTION OF MATERIALS AND WORK

A. Protect all materials from weather and soil when stored and during construction.

B. Protect exposed masonry walls from moisture and keep dry at all times until wall is completed and capped.

C. Keep top of all masonry walls dry at all times when work is not in progress by covering with approved moisture resistant and fire retardant tarpaulins.

D. After erection, protect finished masonry walls from damage due to subsequent building operations. Remove damaged units and replace.

E. Brace all masonry during construction period until final supports are in place.

1.8 DELIVERY AND STORAGE

A. Deliver masonry units and carefully stack on pallets to avoid chipping.

B. Store masonry materials above ground at a height sufficient to prevent soiling. Keep masonry materials dry until placed by storing in a weathertight structure or, if stored in the open, by means of approved moisture resistant tarpaulins, completely enclosing the material.

C. Furnish cement materials in bags displaying manufacturer's trademark and type. Provide material dry and free of lumps when delivered. Upon delivery, store material in dry, weathertight, and properly ventilated structures. Store different brands or types of mortar separately and do not intermix.

D. Store masonry reinforcement above ground and protect from contact with the soil. Store anchors and ties in containers in a weathertight structure.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.2 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes as required for corners, control joints, jambs, heads, lintels, and headers, for use where indicated.
2. Provide bullnose corners at all outside corners.

B. Concrete Masonry Units: Load-bearing hollow and solid concrete masonry units, medium weight, unless otherwise indicated, moisture-controlled, conforming to the following unless more stringent requirements specified:

1. Hollow and Solid Units: ASTM C 90, Type 1.
2. Unit Compressive Strength: Minimum average net area compressive strength of f'm 2000 psi (13.8 MPa).
3. Linear Shrinkage: Not to exceed .065 percent.
4. Size (Width): Manufactured to dimensions 3/8 inch (9.5 mm) less than nominal dimensions.

C. Provide two-core concrete masonry units for all reinforced masonry walls, unless indicated otherwise.

D. No overall dimensions, width, height, length to differ by more than 1/8 inch (3.2 mm) from the specified standard dimensions. Units uniform as to dimension. Provide planar face surface with no variations greater than 1/32 inch (0.8 mm).

E. Provide concrete masonry units with a face shell thickness conforming to ASTM C 90, sufficient to adequately embed masonry reinforcement.

2.3 CURING CONCRETE MASONRY

A. Cure concrete masonry units by either high pressure steam autoclave, saturated steam at atmospheric pressure, or air mist curing.

B. Concrete masonry units that have been cured at a saturated steam pressure of at least 120 psi (0.8 MPa) at a temperature of 350 deg F (177 deg C) for 5 hours or more may be used no sooner than three days after removal from the autoclave.

C. Yard cure concrete masonry units which have been cured by saturated steam or air mist at atmospheric pressure for at least 28 days before use.

2.4 MORTAR AND GROUT

A. Materials and Proportions: Conform to ASTM C 270; proportion specifications with the following amendments:

1. ASTM Section 3.1: Cement to be portland cement, Type 1, natural or white as required to match mortar color, of a manufacture selected to achieve the required color. Hydrated lime to conform to ASTM C 207, Type S, (Special Hydrated Lime).
2. Portland Cement Lime Mix: Packaged blend of portland cement meeting ASTM C 150, Type I and hydrated lime meeting ASTM C 207. For pigmented mortars, use premixed, colored masonry cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Pigments not to exceed 5 percent of masonry cement by weight for mineral oxides, nor 1 percent for carbon black.

B. Aggregate for Mortar: Re-screened, clean, sharp, washed and free from loam or clay or other deleterious materials, conforming to ASTM C 144, selected to achieve the required mortar color. Uniformly grade sand from coarse to fine with 100 percent passing a number 4 sieve (4.75 mm), 95 percent passing a number 8 sieve (2.36 mm) and not more than 5 percent passing a number 100 sieve (0.15 mm).

C. Aggregate for Grout: ASTM C 404.

D. Mortar for Unit Masonry: Comply with BIA Technical Notes 8A, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type N.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

E. Grout: Comply with ASTM C 476, and have a minimum 28 day compressive strength of 3000 psi (20.7 MPa).

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (203 to 280 mm) as measured according to ASTM C 143/C 143M.

F. Do not use calcium chloride admixtures, anti-freeze liquids, salts, or other substances in the mortar or grout.

G. Water: Potable, clean, and free from injurious amounts of oil, alkali, acids, organic materials, or other deleterious materials.

2.5 TIES AND ANCHORS

A. Masonry Anchors: Hot-dipped galvanized steel, unless shown otherwise, rolled shapes, bars, and dowels, size and thickness as indicated. Anchors slotted as required for anchor adjustment. Install anchors at spacing indicated and weld or bolt fasten to steel framing. Touch-up welds with paint or other protection:

1. Hot-Dipped Galvanized after Fabrication: ASTM A 153, Class 2 (1.5 ounce zinc coating per sq. ft.).

B. Hot-Dip Galvanized Steel Wire: ASTM A 153, Class B-2 (1.50 oz. per sq. ft. of wire surface) for zinc coating applied after prefabrication into unit.

C. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch (6 mm) diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.

D. Partition Top anchors: 0.097-inch (2.5 mm) thick metal plate with 3/8-inch (9.5 mm) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6 mm) thick by 24 inches (609 mm) long, with ends turned up 2 inches (50 mm) or with cross pins, unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.6 STEEL REINFORCEMENT

A. Reinforcing Bars: Deformed billet-steel bars for concrete reinforcement conforming to ASTM A 615, Grade 60, hot dipped galvanized, unless noted otherwise.

B. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Mill galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
4. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (406 mm) o.c.
6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch (16 mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.7 MASONRY WALL REINFORCEMENT

A. Refer to Structural Drawings and Notes.

2.8 CONTROL & EXPANSION JOINT MATERIALS

A. Bond Breaker Strips: For use in end webs of concrete masonry units at indicated control joints, 15 pound asphalt or coal-tar roofing felt. Externally applied joint fillers, sealant and backer material is specified in Division 07 Section.

B. Flexible Joint Filler Strips: Built-in between concrete masonry where indicated; molded from natural or synthetic rubbers, alone or in combination, conforming to ASTM D 2000, and neoprene conforming to ASTM D 1056, Grade SCE-41, as manufactured by Williams Products, Inc., Hohmann & Barnard, Inc., or Dur-O-Wal.

C. Control and Expansion Joint Material: For use in masonry walls where indicated; preformed 4-tube, closed cell sponge neoprene, approximate 3-1/4 inches (79 mm) width, "Type NN Joint Filler" as manufactured by Williams Products, or an approved equal product.

2.9 FLASHING MATERIALS

A. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between 2 layers of glass-fiber cloth.

B. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.76 mm).

1. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Edge Drip: Stainless-steel, 0.015 inch (0.38 mm) thick.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry:

1. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION - GENERAL

A. Comply with referenced unit masonry standards and other requirements indicated applicable to each type of installation included in project.

B. Thickness: Build cavity walls and other masonry construction to the full thickness shown.

C. Cut masonry with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

3.3 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of walls, and arises, do not exceed 1/4 inch in 10 feet (6 mm in 3 m), nor 3/8 inch in 20 feet (9.5 mm in 6.1 m), nor 1/2 inch in 40 feet (13 mm in 12.2 m) or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet (6 mm in 6.1 m), nor 1/2 inch in 40 feet (13 mm in 12.2 m) or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (13 mm) maximum.

B. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm). Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch (3.2 mm). Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch (3.2 mm). Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch (3.2 mm). Do not vary from collar-joint thickness indicated by more than minus 1/4 inch (6 mm) or plus 3/8 inch (9.5 mm).

3.4 LAYING MASONRY WALLS

A. Carefully layout masonry work before installation to insure proper location of openings, joints, building returns and offsets. Adjust dimensions only when approved, and when required by variations in the masonry unit dimensions.

B. Provide plumb, true to line work, with courses level and accurately spaced to the vertical dimensions indicated.

C. In unexposed masonry, deviations from running bond in all vertical joints not to be less than 2 inches (50 mm).

D. Provide size of any two adjacent masonry units within permitted tolerances so that the difference between the vertical faces not to exceed 1/16 inch (1.5 mm) when used in exposed-to-view walls.

E. Provide units in exposed-to-view locations free from chipped edges or other imperfections detracting from the appearance of the finished work.

F. Remove any masonry that is moved or disturbed after laying; clean thoroughly and relay in fresh mortar.

G. Rake or step back unfinished masonry work; toothing will not be permitted without prior approval.

3.5 MORTAR

A. Mix mortar in accordance with ASTM C 270 for job-mixed mortar or ASTM C 1142 for ready-mixed mortar. Proportion portland cement lime mortar and mix for types of mortar indicated.

B. Perform hand mixing when permitted, in a tight mortar mixing box. Mixing time not less than required to reproduce results obtained by machine mixing after the required amount of water has been added.

C. Place mortar in final position within 1-1/2 hours after mixing. Discard mortar not used within the specified time limit.

3.6 JOINTS

A. Tool joints evenly to a dense concave profile, unless noted otherwise, with surface and edges thoroughly compacted and sealed.

B. Provide average 3/8 inch (9.5 mm) joint thickness, except where indicated elsewhere. Provide a minimum increase or decrease joint thickness to meet indicated wall dimensions, and to avoid cutting, squeezing or opening of joints at ends of runs or lifts.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.
4. Where new masonry walls abut exiting concrete members provide #3 dowels at 16" c.c. Dowels shall be drilled and epoxy set into the existing concrete and extend 8" into the new wall.

3.8 CONTROL & EXPANSION JOINTS

A. Control and Expansion Joints: Locate, space, and construct as indicated, or as recommended by NCMA.

B. Control Joints in Concrete Masonry: Construct control joints meeting ACI 530.1 requirements, unless otherwise indicated or specified. Use standard stretcher units to provide a continuous unbroken vertical joint, 3/8 inch (9.5 mm) wide, through the entire thickness of the wall. Line one side of the joint with roofing felt. Completely fill core space with mortar; rake joint clean to a minimum depth of 1 inch (25 mm); leave ready for rod backer and sealant. Joint spacing not to exceed 24 feet (7.3 m) on center.

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 FLASHING

A. Provide fabric flashing at wall openings, beams, head and sills, grade, building expansion joints, and in all locations where fabric flashing is built into the masonry.

B. Flashing of Wall Openings and Through-Wall Flashings: Conform, in general, to SMACNA Plates 46 and 47. Extend flashing 4 inches (101 mm) or more beyond edge of lintels and turn up edge on sides and back to form pan and to direct moisture to exterior; lap joints not less than 2 inches (50 mm); embed lap joints in bituminous mastic cement; extend flashing to face of wall. Install metal drip edges beneath fabric flashing at exterior face of wall; stop flashing 1/2 inch (13 mm) back from outside face of wall and adhere flashing to top of metal drip edge.

C. Build-in flashing in walls, below copings, in expansion joints, and where indicated. Refer to Section 076200 "Sheet Metal Flashing and Trim."

D. Build-in vertical expansion joint.

E. Make joints in concealed metal flashing by lock seams or laps, which are mechanically fastened and sealed watertight with bituminous mastic cement. Seal spaces around dowels and all openings in flashings with mastic before covering the flashing with mortar.

3.10 LINTELS & BOND BEAMS

A. Provide lintels at required masonry openings.

B. Refer to Architectural, Mechanical and Electrical Drawings for openings; provide lintels for all openings.

C. Unless otherwise noted, provide steel angles and beam lintels for masonry openings, as scheduled on Drawings. Provide hot-dipped galvanized for exterior openings.

D. Provide block lintels where indicated, made up of 16 inches (406 mm) nominal length bond beam blocks and reinforced as indicated. Match texture of block with adjacent masonry units.

E. Concrete masonry and precast lintels as shown on Drawings.

F. Provide minimum of 8 inches (203 mm) bearing, unless noted otherwise, for all lintels at each side of opening.

3.11 INSTALLATION OF REINFORCEMENT

A. Masonry Reinforcement: Install in all bed joints at 16 inches (406 mm) vertical spacing, starting at 16 inches (406 mm) above the first course. Also install reinforcement in the first and second bed joints, 8 inches (203 mm) apart, immediately above lintels of all openings. Extend reinforcement in the second bed joint above all openings two feet beyond jambs. Provide all other reinforcement continuous, except do not pass through vertical masonry control or expansion joints. Lap side rods 6 inches (152 mm) at splices. Place reinforcement to assure a minimum of 5/8 inch (16 mm) mortar cover on the exterior face of the wall and 1/2 inch (13 mm) mortar cover on interior faces.

3.12 BUILT-IN WORK

A. Built-in materials occurring in any type of masonry construction shown and/or specified to be furnished by other Trades. Accurately place all built-in work, securely hold in position, and locate as directed.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and special inspections indicated below and on Structural Drawings; prepare test reports:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.

C. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

D. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for compressive strength.

E. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

F. Prism Test: For each type of construction provided, per ASTM C 1314 at 7 days and at 28 days.

3.14 CUTTING, FITTING AND PATCHING

A. Cutting and fitting of masonry as required in existing masonry and to meet building dimensions performed by masonry mechanics using masonry saws.

B. Skillfully perform work with unbroken edges cut plumb and true.

C. Carefully patch and match original adjacent surfaces in materials and workmanship.

3.15 PROTECTION

A. Take precautions to protect the finished work from damage by other trades.

3.16 POINTING AND CLEANING

A. Dry brush masonry walls at the end of each day's work.

B. Upon completion of the work, rake all holes and defects in exposed mortar joints as required, and then fill with fresh mortar and tool as specified.

C. After mortar is thoroughly set and cured, dry clean by removing mortar particles with wood paddles, brush and scrapers before wetting the wall.

D. Clean masonry with stiff brushes, cleaning tools, and clear water. Do not use acid in the cleaning process. Rub joints with a carborundum stone to remove burrs and rough edges.

E. Abrasive blasting techniques for cleaning will be permitted only when approved in writing by Architect.

END OF SECTION 042000

SECTION 050300 - HOT DIP GALVANIZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Hot dip galvanize all permanently exposed structural steel including but not limited to structural steel, columns, beams and metal fabrications.

1.2 QUALITY ASSURANCE

A. Comply with requirements of Section 014000.

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

1.3 SUBMITTALS

A. Comply with requirements of Section 013300.

B. Coating applicator's notarized Certificate of Compliance that the hot dip galvanized coating meets or exceeds the specified requirements of ASTM A 123 or A 153.

1.4 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 016100.

B. Load and store galvanized articles in accordance with accepted industry standards.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Material for galvanizing to be geometrically suitable for galvanizing as described in ASTM A 384 and A 385. Steel materials suitable for galvanizing include structural shapes, pipe, sheet, sheet, fabrications and assemblies.

B. Material shall be chemically suitable for galvanizing.

2.2 FABRICATION REQUIREMENTS

A. Fabricate structural steel in accordance with Class I, II, III guidelines as described in AGA's Recommended Details for Galvanized Structures.

B. Fabrication practices for products shall be in accordance with the applicable portions of ASTM A 143, A 384 and A 385, except as specified herein. Avoid fabrication techniques which could cause distortion or embrittlement of the steel.

C. The fabricator shall consult with the Architect and hot dip galvanizer regarding potential problems or potential handling problems during the galvanizing process, which may require modification of design before fabrication proceeds.

D. Remove all welding slag, splatter, anti-splatter compounds, and burrs prior to delivery to the galvanizer.

E. Provide holes and/or lifting lugs to facilitate handling during the galvanizing.

F. Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil pint and other deleterious material prior to fabrication.

G. Remove by blast cleaning or other methods, surface contaminants and coatings which would not be removable by the normal chemical cleaning process in the galvanizing operation.

H. Wherever possible, use slip joints to minimize field welding of material.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Pre-clean steelwork in accordance with accepted methods to produce an acceptable surface for quality hot dip galvanizing.

3.2 COATING APPLICATION

A. Galvanize steel members, fabrications, and assemblies after fabrication by the hot dip process in accordance with ASTM A 123.

B. Galvanize bolts, nuts and washer and iron and steel hardware components in accordance with ASTM A 153.

C. Safeguard products against steel embrittlement in conformance with ASTM A 143.

D. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

3.3 COATING REQUIREMENTS

A. Coating weight: Conform to paragraph 5.1 of ASTM A 123 or Table 1 of ASTM A 153 or requirements indicated in individual sections of this Project Manual, as appropriate. Special thickness requirements shall refer to ASTM A 123 3.1.7 and be specified to the minimum average mils of thickness.

B. Surface finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.

C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.4 TESTS

A. Inspection and testing of hot dip galvanized coatings shall be done under the guidelines provided in the AGA publication Inspection of Products Hot Dip Galvanized after Fabrication.

B. Include visual examination and tests in accordance with ASTM A 123 or A 153 as applicable to determine the thickness of the zinc coating on the metal surface.

3.5 REPAIR OF DAMAGE COATING

A. The maximum area to be repaired is defined in accordance with ASTM A 123 Section 4.6.

B. Repair areas damaged by welding, flame cutting or during handling, transport or erection, by one of the approved methods in accordance with ASTM A 780 whenever damage exceeds 3/16" in width. Minimum width thickness requirement for the repair are those described in ASTM A 123 Section 4.6.

END OF SECTION 050300

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:

1. Requirements: Provide structural steel, complete, in accordance with Contract Documents.

B. Related work in other Sections:

1. Section 033000 – Cast-In-Place Concrete. Placing embedded items and other anchor bolts.
2. Section 036000 – Grout.
3. Section 053000 – Steel Decking.
4. Section 055000 – Metal Fabrication.
5. Section 050300 – Hot Dip Galvanizing.
6. Section 051213 – Arch. Exposed Structural Steel Framing.

1.2 QUALITY ASSURANCE

A. Quality Assurance: Prepare and execute full and complete program of Quality Assurance including evaluation, material reports, sampling, appropriate types and quantities of testing, and detailed fabrication and erection drawings which provide no opportunity to complete unsatisfactory steel work. Perform retesting or evaluations by Quality Control Personnel due to deficient work and similar work at no additional cost to Owner.

B. Quality Control: Steel work is subject to evaluation and tests in shop and field by others. Evaluations and testing undertaken by others is strictly for random evaluation. Extent, duration and amount of testing and evaluation are entirely at discretion of others. Use of testing services, execution of testing or evaluation services by others shall in no way relieve sole responsibility to furnish materials and construction in full compliance with Contract Documents.

C. Testing Agency: Owner will engage, at his expense, certified Testing Agency to inspect materials, fabrication, high strength bolted connections and welds, to perform test specified, and to submit reports to Architect and Local Building Authority.

1. Testing Agency will be responsible for conducting and interpreting tests, will state in reports whether test results comply with Contract Documents, will specifically note deviations there from, and will indicate corrective measures required and taken.
2. Testing Agency inspectors shall keep daily records of work inspected and its disposition in accordance with form prescribed in "Structural Welding Code."
3. Provide Testing Agency with the following:

    a. Shop and erection drawings.
    b. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
    c. Information as to time and place of rollings and shipment of material to shop.

d. Access to places where material is being fabricated or produced.
e. Representative sample pieces requested for testing.
f. Full and ample means and assistance for testing.
g. Proper facilities, including scaffolding, temporary work platforms and hoisting facilities for inspection of Work in field.

4. Contractor shall provide and pay for corrective measures, including additional and more complete testing.
5. Architect and Testing Agency may observe structural steel at plant before shipment; however, Architect reserves the right to reject material, at any time before final acceptance which does not conform to requirements of Contract Documents.
6. Unless more stringent requirements are stated elsewhere, be responsible for extra cost due to:

a. Inspections and testing required off-site greater than 75 miles from the job site.
b. Inspections and testing required at more than one off-site location.
c. Overtime inspections and testing incurred without Owner's Approval or for acceleration of work for Contractor's convenience.

D. Source Quality Control:

1. General: Material delivered with certificates classified as identifiable; without certificates classified as unidentifiable. High strength steels shall be suitably identified on each piece and reviewed by the testing Agency in comparison to mill test certificates.
2. Testing of Unidentifiable Material: By testing agency; paid for by Contractor.
3. General: Test material not identifiable by heat number and mill test or other acceptable manufacturer's identification per ASTM A370 as follows:

a. Structural shapes and plates: From coupons taken from material; one tensil test and one bend test per five tons of each shape.
b. High Strength Bolts: Each lot of 100 bolts; tensile tests on two bolts in full size and one tensile test on half-inch diameter machined specimen.

E. Bolted connections shall be inspected by Testing Agency in accordance with AISC Specification for "Structural Joints using ASTM A325 and A490 Bolts."

1. All bolts shall be inspected as "fully-tensioned" unless specifically identified on the drawings that the bolt may be only tightened to "snug-tight" condition.

F. Welding shall be inspected and tested by Testing Agency during fabrication (unless the shop is approved by the engineer and building official per section 1701.7 of the code) and erection of structural steel in accordance with AWS as follows:

1. Certify welders and make inspections and tests as required. Record types and locations of defects found in Work, and measures required and performed to correct such defects.
2. In addition to visual inspection of welds, magnet particle and ultrasonic inspection shall be made. Magnetic particle inspection shall be made on root pass and finish weld.
3. Method of magnetic particle inspection shall be in accordance with ASTM E109. Cracks or zones of incomplete fusion or penetration not acceptable. Equipment shall be capable of locating cracking below surface of welds. Check a minimum of 15% of all fillet welds distributed throughout the work and 25% of all fillet welds of built-up sections. 100% of fillet welds for moment resisting frames and braced frames shall be magnetic particle tested.

4. Perform ultrasonic inspection in accordance with AWS D1.1. 100% of all partial and complete penetration shop and field welds shall be ultrasonically tested.
5. All welding inspection and testing of moment resisting frame welds shall be per formed by an experienced deputy welding inspector qualified at NDT Level II for ultransonic and magnetic particle testing. In addition, inspectors shall have supple mental qualifications as defined in FEMA 353 Appendices E and F.

G. Testing Agency shall inspect structural steel for laminations or other discontinuities by ultrasonic methods.

1. Ultrasonic testing shall be performed on all sections in ASTM A6 Groups 4 and 5 and in Group 3 where flange or web thickness exceeds 1-1/2". In addition, all plates exceeding 2" in thickness shall be tested.
2. Testing shall be performed in accordance with ASTM A435 for plates and ASTM A898 for rolled sections.
3. The test area shall consist of a column flange zone extending at least 3" above and below each beam flange CPJ connection. Column webs shall be similarly tested for weak axis connections. Similar zones for plates in built-up sections and base plates shall also be tested. Tests shall be performed prior to fabrication and after final welding.
4. For plates any discontinuity causing total loss of back reflection that cannot be contained within a circle 3" in diameter or 1/2 the plate thickness, whichever is greater, shall be rejected.
5. For rolled shapes ASTM A898 Level I criteria are applicable.

H. Each bolting crew and welder shall be assigned identifying symbol or mark. Shop and field connections shall be identified so that inspector can refer back to crew or person making connection.

1. Testing Agency shall confirm qualification of welders, AWS procedures are followed, Welding equipment is used per manufacturer's recommendations, preheating is properly used, proper use of runout plates, jigs, and fit-up, and structural steel complies with specific dimensional standards.

I. Where inspections reveal defects, extent of inspection will be increased as necessary to assure that full extent of defects in joint has been found and to assure that same defects are not present in welds made on similar parts or under similar circumstances.

1.3 REFERENCES

A. Except as modified by governing codes and by Contract Documents, comply with applicable provisions and recommendations of the following:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
3. AWS "Structural Steel Welding Code."
4. Industrial Fastener Institute "Handbook on Bolt, Nut and Rivet Standards."
5. SSPC "Steel Structures Painting Manual, Volume 2 Systems and Specifications."
6. "Specifications for Structural Joints Using ASTM A325 or A490 Bolts," approved by research council on Riveted and Bolted Structural Joints of the Engineering Foundation
7. ASTM A6 "General Requirements for delivery of Braced Steel Plates, Steel Piling and bars for Structural Use."

1.4 SUBMITTALS

A. Product Data: Include laboratory test reports and such other data required to show compliance with Contact Documents. Indicate by transmittal form that copy of each applicable instruction has been distributed to each Installer or Fabricator.

1. Structural Steel: (each type) including certified copies of mill reports covering chemical and physical properties, country and rolling mill of origin, and including statement indicating that steel is new billet steel and that testing has been performed in accordance with ASTM standards. Correlate individual heat numbers with each specified section and location. Retest steel if test results are unsatisfactory.
2. High Strength Bolts: (each type) including nuts and washers. Provide test reports for each production lot indicating proof load, tensile strength (wedge test), and hardness. Provide certified copies of mill reports covering chemical and physical properties, country and rolling mill of origin, and including statement indicating that steel is new billet steel and that testing has been performed in accordance with ASTM Standards. Retest bolts if test are unsatisfactory.
3. Welding Electrodes: (each type).
4. Shop Coat Primer paint: Field touch-up paint; manufacturer's specifications, performance data, and application instructions.
5. Shop applied shear stud connectors.
6. Anchor Bolts.

B. Shop Drawings: Submit Shop Drawings for the following items in accordance with Division 1 prepared under supervision of a Registered Professional Engineer with current registration in State of California, including complete details and schedules, all shop and erection details for fabrication and assembly, all connections and holes, bolts and welds. All welds, both shop and field shall be indicated by the AWS Standard Welding Symbols.

1. Provide shop fabrication drawings, which show details, schedules and other information necessary for fabrication of each member and for shop assembly of members of structure.
2. Indicate type, size, location and extent of welds and bolts. Clearly distinguish between shop and field bolts and welds. Indicate member splices and plate splices on shop drawings, for both shop and field. Indicate AISC pre-qualified welds by designation that indicates root and bevel angles for partial and full penetration welds as well as the specific weld process and the fabricator's specific identification for the welding procedure specification, which includes preheating and other requirements.
3. Provide field assembly and erection drawings which show field assembly prior to erection and after erection. Indicate details, schedules and diagrams showing field assembly. Procedures shall indicate intermediate surveys, cambers, member over length, and allowances for temperature. Include setting drawings and templates for column base plates.
4. Provide written procedure of each item and welding sequence including preheating and cool down at each joint to minimize effect of weld shrinkage residual stress, and to maintain erection tolerances.
5. Identify each type and class of welding electrodes.
6. Non-domestic fabrication shall be in accordance with shop drawings prepared domestically by structural steel detailers commonly providing services to domestic fabricators. Form and character of shop drawings shall be to Architect's satisfaction, be checked and complete. Reuse of the Contract Documents is not permitted.

C. Calculations: Submit calculations for connections proposed as substitutions for indicated connections, and for connections where design criteria and loads are indicated. Submit calculations bearing seal of Professional Engineer registered in state where project is located.

D. Surveys: Submit certified surveys by Contractor's registered professional engineer, showing elevations and locations of base plates and anchor bolts to receive structural steel, and showing elevations and locations for major members, with particular notation of discrepancies between actual installation and Contract Documents, signed by Contractor, Erector and Surveyor.

E. Testing and Inspection Reports.

F. Welders Certifications, Welding Procedure Specifications, etc.

G. Prior to fabrication, prepare and submit to Testing Agency and Architect written Quality Assurance Program including material identification, welder certifications/ re-certifications, welding procedure specifications, etc. as well as all procedures for shop fabrication and field connections for steel work. These procedures shall indicate Fabricator's quality control measures, monitoring and repair procedures. Weld details and procedures shall be in accordance with AISC and AWS pre-qualified details, procedures and standards, as well as, particularly pre-qualified welding procedures and particularly pre-qualified welder certifications for each complete penetration shop and field welding process and detail.

1.5 STORAGE AND HANDLING

A. Comply with the requirements of Division 1.

B. Plan method and sequence to avoid delay or damage to steel work or work of other trades.

C. Be responsible for steel shipment to site and storage of fabricated steel at job site. Material stored at job site shall not exceed design loads on structures so that members will not be distorted or otherwise damaged; and shall be protected against corrosion or deterioration.

D. Stack materials out of mud and dirt and provide for proper drainage. Protect from damage or soiling by adjacent construction operations.

E. Provide temporary shoring, bracing the guy lines to adequately protect all persons and property and to ensure proper alignment.

1.6 ALTERNATIVES

A. Substitutions for member sizes, type(s) of steel, connection details or other modifications proposed by Contractor will be considered by Architect only under following conditions:

1. That request has been made and accepted prior to first submission of any shop drawings. The initial submittal of erection plans shall record the substitution of any members or material grades.
2. That there is substantial cost advantage and time advantage to Owner; and that proposed revision is necessary to obtain required materials at proper time to accomplish work in time scheduled. Substitutions proposed due to lack of timely ordering of material are not acceptable.

3. That sufficient sketches, engineering calculations and other data have been submitted to facilitate Architect checking, including the dimensions and weight of both the original and substitute members, connections, and the relationship of the substitute member, or modification of details to adjacent work.
4. The cost reduction and savings in time to complete work shall also be submitted. The substitutions shall not affect the architectural design and be equal or greater than the original member in structural characteristics, and at no additional cost to the owner.

B. Substitution of higher yield strength steels is not acceptable for moment frame and braced frame brace members in the lateral load resisting system.

C. Substitution of higher yield strength steels or Dual Certified steels may be acceptable for other members if found acceptable under the provisions of paragraph A, and the member size is not changed.

D. Alternative column splice locations or alternatives to provide a single size column where a spliced column is shown, will probably not be acceptable substitutions, particularly for columns in the lateral loading resisting system.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel:

1. Structural steel for rolled wide flange shapes shall comply with provision of ASTM Specifications appropriate for grades indicated. Provide ASTM A992 steel, unless noted otherwise.
2. Structural steel plates and bars shall be ASTM A572-50 as indicated on the drawings.
3. Structural steel angles and channels shall be ASTM A36 or ASTM A572-50 as indicated on the drawings.
4. Structural steel tubes shall be ASTM A500, grade B (46 ksi) as indicated on the drawings.
5. Structural steel pipes shall be ASTM A53 type E or S, grade B. as indicated on the drawings. (U.N.O. on the drawings)
6. Dimensional Standards: ASTM A6; welded shapes per dimensional standards of mill rolled sections.
7. Quality: Sound, free from loose mill scale, cracks, laminations and slag inclusions.
8. Column sections and plates thicker than 1-1/2" inches shall be fine grained killed steel.

B. Welding Electrodes: Comply with provisions of AWS "Structural Welding Code" and Specification A5.1, A5.5, A5.17, A5.18, A5.20 and A5.29.

C. High strength bolts and high strength bearing bolts, nuts and washers: Comply with provisions of:

1. ASTM A325 or A490, as noted.
2. AISC Specification for "Assembly of Structural Joints Using High Strength Bolts."
3. All bolts in slip critical frame connections shall be hex head without beak-off splines, etc. unless direct tension indicating washers are provided at all slip critical connections. Use of break-off spline bolts in non-frame, gravity connections is acceptable.

D. Welded Studs: By Tru-Weld, Nelson Stud Welding Div. of Gregory Industries, and Stud Welding and Rebar Splicing Division of Erico Products, Inc. complying with the following.

1. Standard steel studs for welding by automatically timed stud-welding equipment, furnished complete with an arc shield (ferrule) of heat-resistant ceramic for all studs and, for studs 5/16 in. diameter or larger, a deoxidizing and arc stabilizing flux; not painted, galvanized, or cadmium-plated prior to welding and all finished by cold-heading, cold-rolling or machining.
2. Provide studs of uniform quality and condition, free of injurious laps, fins, seams, cracks, twists, bends not indicated, rust, rust pits, scale, oil and other injurious defects or substances.
3. Steel shall be Grade C-1015, C-1017 or C-1020, cold-drawn, conforming to ASTM A 108 and having minimum 60,000 psi tensile strength with 20% elongation in 2 in. and 50% area reduction.

E. Paint:

1. Paint shall be confirmed to meet all Code requirements.
2. Prime Paint: Tnemec's V10 Red Primer.
3. Hot dip galvanize all steel work permanently exposed to the exterior including bolts, nuts, washers, etc.

F. Miscellaneous Materials:

1. Provide miscellaneous materials or accessories as indicated or required for good construction practice.
2. Provide supplemental structural steel support framing for metal deck where normal deck bearing is precluded by column flange plates or other framing members and around minor floor openings where indicated.
3. High Strength Anchor Bolts – ASTM A354 Gr BD or ASTM A449 as indicated on the drawings.

2.2 FABRICATION

A. General: Fabricate per AISC Specifications. Properly mark materials where field assembly requires. Sequence material shipments to expedite erection and minimize field handling.

B. Planning and milling:

1. Mill bearing surfaces to true planes. Mill ends of columns perpendicular to centerline axis connected mid depth points at ends of member. Milled surfaces shall be completely assembled or welded before milling. Cut and fit column and bearing stiffeners to give full bearing over cross section.
2. Column Base Plates:

    a. From 2 inches through 4 inches thickness: Straighten by pressing.
    b. Over 4 inches thickness: Plane top for column bearing; Plane bottom when bearing on steel.

C. Holes, Cutout and Filling: Provide where indicated for other trades. No additional holes, cutouts, or fittings permitted without written permission.

D. Camber: Fabricate beams, girders and assemblies with natural camber upward, unless otherwise indicated.

E. Connections shall be as indicated. Alternate connections may be required due to erection or other conditions. Connections for shop or field connections or splicing shall be shown on shop fabrication drawings for review prior to fabrication.

F. Detail connections by fabricator based on information indicated and considerations of shipment and erection. Detailing shall be performed using rational engineering design and standard practice in accordance with AISC. Details indicated on Drawings may be subjected to minor changes during detailing.

G. No combination of bolts and welds shall be used for stress transmission in same faying face of connections.

H. Automatic or semi-automatic welding may be used per AWS procedure.

I. Welding, filler metal, welding techniques, qualified welders, and procedures shall be in accordance with AISC Specification for "Design, Fabrication and Erection of Structural Steel for Buildings," and AWS "Structural Welding Code" and "Filler Metal Specifications."

J. Clean steel in areas where paintings, welding, bolting, stud welding, metal deck welding will be performed.

K. Welding processes other than shielded metal arc and submerged arc may be used provided procedure qualification tests in accordance with American Welding Society are made for intended application of such process. Testing and Submittal for test reports shall be submitted with proposed locations of use for review prior to Shop Drawings Submittal and shall have been identified during bidding and reviewed.

L. Built-up sections assembled by welding shall be free of warping and axes shall have alignment within specified tolerances.

M. Welds not specified shall be continuous fillet weld, using not less than minimum size and specified by AWS.

N. Welding sequences shall be such to reduce residual stresses due to welding to minimum value.

O. Toughness and notch sensitivity of steel shall be considered in formation of welding procedures to prevent brittle and premature fracture.

1. Welding procedures for complete penetration welds shall include sequences for placing each weld bead as well as pre-heat and post-heating, electrode selection, etc.
2. Welding procedures shall be written and shall be prepared by a qualified welding engineer.
3. Welding procedures shall account for all fabrication orientations and welding conditions, material grades, mill certifications, member sizes, etc.

P. Detail and design welded connections to minimize accumulation and concentration of through-thickness strains due to weld shrinkage.

Q. Detailing of copes/access holes at full penetration welds shall follow FEMA 350 Fig. 3-5.

1. The web cope details shall be compatible with the weld process. The bottom flange web cope shall permit as much welding as possible under the cope and beyond the web.
2. The cope details shall be developed with the consultation of the qualified welding engineer who developed with the consultation of the qualified welding engineer who develops the written welding procedure specification for the welds.

R. Repairs: Remove defects, re-weld, and grind welds flush; method of repairs shall be acceptable to Testing Laboratory. In lieu of repairs, materials with defects may be replaced with new at Contractor's option and expense.

2.3 SHOP PAINTING

A. General: Do not paint when ambient temperature is below 40 degrees Fahrenheit. Paint in dry weather or under cover. Apply paint by brush or spray over dust free surface per manufacturer's directions. Do not thin paint in excess of manufacturer's recommendations. Allow paint to dry before handling the shipment of structural steel.

B. Shop-coat structural steel except the following:

1. Members to be incased in concrete.
2. Contact surfaces of welded connections and areas within 2 inches of field welds.
3. Contact surfaces of high-strength bolted connections.
4. Surface receiving sprayed-on fireproofing or galvanizing.

C. Prime Paint:

1. Surface Preparation: Clean surfaces of loose mill scale, dirt, rust and other foreign matter by use of suitable tools; hand tool cleaner per SSPC-3, commercial blast cleaning per SSPC SP-6 for steel exposed to the elements. Remove oil and grease with cleaners per SSPC SP-1.
2. Application: Apply one coat to dry film thickness not less than 4.0 mils.
3. Zinc Rich Primer Application: Apply one coat to dry film thickness not less than 4.0mils.

D. Machine Finished Surfaces: Carefully protect against corrosion with coat of white lead and tallow or similar protection; apply per AISC requirements prior to shipments.

E. Concealed Surfaces: Paint parts inaccessible after assembly or erection with two coats of primer paint, or different colors.

F. Field Painting:

1. Field paint bolt heads and nuts, welds, abrasions, and unpainted steel work.
2. Field paint with primer paint.
3. Clean completed steel work of foreign materials.

G. Unpainted Surfaces: Remove oil and grease with solvent cleaners; remove dirt and other foreign material by sweeping with wire brushes.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examination: Examine substrates, adjoining construction, and conditions under which Work is to be installed. Do not proceed with Work until satisfactory conditions have been corrected.

3.2 PREPARATION

A. Field Measurements: Establish permanent benchmarks and verify elevations of concrete on which structural steel is to be placed and anchor bolt locations and projections using licensed Professional Engineer registered in State where Project is located. Report discrepancies to Architect before proceeding with Work. Perform remedial work in the shop prior to shipment to the field.

3.3 ERECTION

A. Be responsible for accurate setting and leveling of bearing plates. Furnish templates for accurate setting of anchor bolts. Bearing plates shall be leveled on steel wedges or shims or as otherwise detailed. Grout bearing plates as specified in Section 03600-Grout.

B. Notify grout manufacturer at least twenty-four hours prior to grouting. Do no grouting without grout manufacturer's representative present at site, for initial test plate and initial production work. Train workmen in preparation, placing curing, etc. to the satisfaction of inspector.

C. Erect building frame true and level. Erect columns in manner to allow for shrinkage of girders after welding. Check plumbness after erection of each tier. Maintain structural stability of frame during erection; provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

3.4 ERECTION TOLERANCES

A. Be responsible for correct fitting of structural members and for elevation and alignment of finished structure per AISC Code of Standard Practice (minimum). Be responsible for adjustments to steel work because of discrepancies in elevations and alignments. Furnish shim plates or developed fills where required to obtain fit and alignment.

B. Unless noted otherwise, plumb structure to accuracy of 1 to 1000, but not to exceed ¼ inch per two-story tier. Overall vertical plumbness to be better than 1 to 500, but not to exceed ½ inch maximum. Level horizontal members to accuracy of 1 to 1000 not to exceed +/- 1/4 inch at columns.

C. Measurements relating to above shall be on theoretical centerline of members.

3.5 CONNECTIONS

A. Do no welding or bolting until as much of structure as will be stiffened by welding or bolting has been properly aligned.

B. Do not use drift pins to enlarge unfair holes in main material. Ream holes that must be enlarged to admit bolts. Use of burned holes for bolted connections not permitted and main structural members with burned holes will be rejected. Drifting may be used to align unfair holes in secondary bracing members only, when acceptable to Architect. Maintain minimum edge distances at enlarged holes.

C. When high strength bolts or high strength bearing bolts are used, AISC Specifications shall apply including values as noted therein, and installation shall be to full torques (not snug –tight) be either "turn of the nut tightening" or with torque wrenches. In using manual torque wrenches, required torque can be read from wrench dial. Care should be taken that wrench is properly calibrated. Nuts shall be in motion when torque is measured. In using power wrenches, follow recommendations of manufacturer. Calibrate manual and power torque wrenches at least once daily and for each lot of bolts.

D. Alternative bolting may be accomplished by utilizing Coronet Load Indicator washers as "direct tension indicators" in accordance with current specifications as indicated in AISC, UBC-ICBO Report No. 2885, and manufacturer's recommendations whichever are more stringent. Proposers shall indicate their cost with and without use of indicators for bolting and for use on friction bolted connections only.

E. Pre-qualified welders using pre-qualified welding procedures shall perform all field welding. All field welding of moment resisting frame complete penetration welds of beam flanges to columns and complete penetration column splices shall be performed by particularly pre-qualified welders and pre-qualified welding procedures. Pre-qualification of frame welders shall be by procedures and criteria as described in FEMA 353 Appendix B. Equipment, electrodes and procedures shall be identical to those used in the field production welds. Weld deposition rates of field production welds shall not exceed those of the successfully performed test. The test coupon shall be placed at an elevation and orientation such that the welder works in a position that replicates field conditions. Each shall frame welder shall successfully complete one beam-column coupon and one column splice coupon prior to being permitted to perform field production welds.

1. Welding shall proceed only based on written procedure specifications prepared by a qualified welding engineer.
2. The written procedure specifications shall account for field conditions, material grades, ember sizes, etc.
3. The written procedure specifications shall include specific diagrams of different job conditions showing the sequence of placements of weld beads, extension/ backup/ runoff material, locations of tack welds, start/ stop locations, etc. as well as cleaning, grinding etc. between passes.
4. The procedure shall indicate the sequence for progression of welding within the building as a whole, within frame lines and within individual connections. Sequences shall minimize locked in tensile stresses due to weld shrinkage to the greatest extent possible.
5. The written procedure specification shall indicate pre-heat and post-heat requirements based on the full chemical composition of the abutting steels, field conditions, electrode and weld process, etc. The procedure shall indicate the locations of measurement of temperatures and frequency of measurements.
6. The written procedure specification shall indicate that the bottom flange welds be built up to full size by welding alternately in a uniform manner on both sides of the web. Stops and starts shall be avoided below the web and weld shall proceed under the web cope and beyond as much as possible.

7. The written procedure specification shall indicate removal of extension/ backup/ runoff materials attendant with the top and bottom flange connections as well as gouging the weld to remove any incomplete penetration, slag, etc. of the root passes and reinforcing the bottom of the weld.
8. The written procedure shall indicate the field fit up requirements and tolerances of the root opening.

3.6 SURVEY

A. Make accurate survey of actual locations and cambers of steel members immediately upon completion of erection of steel of entire structure and promptly submit same to Architect. Should locations vary beyond allowable tolerances, take necessary corrective measures and modify details and/ or procedures as required.

B. Survey information shall have sufficient actual elevations of steel and cambers to allow other trades to correlate with expected deflections in setting screeds and verifying metal deck gauge.

END OF SECTION 051200

SECTION 052000 - METAL JOISTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Open web steel joists.
2. Bracing and bridging.
3. Supplementary parts and components, such as clips, fasteners, supplementary framing, and other miscellaneous accessories required for a complete installation.

B. Related work:

1. Division 3 for grouting bearing plates.
2. Division 5 for structural steel.

1.2 SYSTEM DESCRIPTION

A. Open web steel joist assemblies are not fully detailed on the Drawings, which are diagrammatic and show basic dimensions, alignment and profiles of members and their relationship to other building components.

B. Layout and joist sizes indicated are based on manufacturer's published span tables.

C. Design requirements:

1. Engineer, fabricate, assemble and install joists to meet or exceed the criteria indicated and specified, to conform to the profiles indicated and to other requirements of the Contract Documents and to satisfy the requirements of the authorities having jurisdiction.
2. If required by the authorities having jurisdiction, prepare and submit reviewed shop drawings, specifications, calculations and any other supporting data required for review and approval, and pay fees incurred, prior to beginning installation.
3. Engineering calculations for these assemblies shall bear the signature and seal of a California-licensed professional engineer.

D. Performance requirements:

1. Dead and live loads:

   a. Provide assemblies, including anchorage, that accommodate the supporting structure deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.
   b. Limit deflection to L/360 under dead and live loads.

2. Seismic loads: Provide assemblies, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction.

1.3 SUBMITTALS

A. Data:

1. Product data: Submit manufacturer's product data, specifications, typical installation details and other data as necessary to demonstrate compliance with the specified requirements.
2. Design data: Submit engineering calculations demonstrating compliance with the requirements of the authorities having jurisdiction for manufacturer-engineered assemblies.

    a. Calculations shall be legible and shall incorporate sufficient cross-references to shop drawings to make calculations readily understandable and reviewable.
    b. Test reports are not an acceptable substitute for calculations.
    c. Calculations shall include:

        1) Yield Strength of material and loads for which joists were designed.
        2) Web, chord, end panel, bearing seat, bridging and weld design, including splices.
        3) Joist camber
        4) Seal and signature of design engineer.

B. Shop drawings

1. Submit large scale, dimensioned drawings showing, member profiles, materials, member sizes, dimensions and hardware.
2. Include complete joist plan layout with each joist cross-referenced to the structural calculations.

    a. Show location and spacing of joists by identification marks.
    b. Indicate design loading of joists and allowable stress increases, camber and permanent bracing/bridging

3. Identify welds by AWS welding symbols.
4. Show connections to adjacent construction, including details of the following:

    a. End anchorages, including minimum bearing requirements.
    b. Bottom chord anchorage, including locations of connections.
    c. Shop splices.
    d. Spacing and number of bridging rows.
    e. Bridging-to-joist connections and connections of bridging lines terminating at walls or beams.
    f. Accessories required for uplift and their locations.

5. Furnish isometric drawings for conditions too difficult to illustrate in 2 dimensions.
6. Coordinate the shop drawings with the work of other trades that are part of, or will be incorporated into, the work of this section. Indicate work to be performed by other trades, including adjacent and abutting materials to which this work is to be secured.

C. Certifications: Submit letter from joist manufacturer stating that joist design, materials, and workmanship meet or exceed the specified requirements.

D. Test reports: Testing agency shall submit inspection reports to the Architect, stating in each report whether or not fabrication is in conformity with requirements of shop drawings, Contract Drawings and Specifications.

1. Deviations from shop drawings, Contract Drawings and Specifications, if any, shall be expressly noted.
2. Results of the performance load test called for hereinbefore shall be included with the appropriate inspection report.

1.4 QUALITY ASSURANCE

A. Uniformity: Obtain joists used for the Project from the same manufacturer.

B. Fabricator/installer's qualifications:

1. Firm and individuals with a minimum of 5 consecutive years experience in the design, fabrication and installation of specified products on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
2. Obtain joists only from a manufacturer who will send a qualified technical representative to the Project site before covering the work of this section to review installation.

C. Welder's qualifications: Qualify welding operators and welding procedures in compliance with AWS "Qualification" requirements of AWS D1.1 for steel.

1. Verify welders to be employed in this work have satisfactorily passed AWS qualification tests and are current in their certification.
2. If re-certification is required, retesting will be Contractor's responsibility.

D. Testing agency qualifications:

1. Employ an independent testing agency acceptable to authorities having jurisdiction, qualified to conduct the testing indicated.
2. Personnel conducting tests shall be qualified as required by the authorities having jurisdiction.

1.5 HANDLING

A. Delivery: Deliver materials to project site in original protective wrappings, clearly labeled with manufacturer's identification labels intact and legible, indicating manufacturer's name, type, source of product and date of manufacture.

B. Storage: Store joists as shipped, in original wrappers, upright and off the ground on support blocks as recommended by the manufacturer.

C. Handling:

1. Procedure: In accordance with "Handling and Erection of Steel Joists and Joist Girders" by the Steel Joist Institute (SJI).
2. Handle products to avoid bending, deformation or damage. Do not dump, drop, or throw.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Joists:

1. Steel plates, shapes, and bars: ASTM A 36.
2. Provide joist series indicated with ceiling extensions on all joists, unless otherwise indicated.

B. Miscellaneous items:

1. Provide bridging of size(s) and shape(s) required by design conditions, and space accordingly. Use diagonal bridging for all floor construction.
2. Provide headers, bearing plates, anchors, clips, and other accessories required for a complete installation.

C. Paint: For steel joists scheduled to receive a high-performance coating: As specified in Section 09905.

2.2 FABRICATION

A. Comply with AISC for dimensional tolerances.

B. Reinforce joists for concentrated loads occurring between panel points, as detailed.

C. Welding: Qualify joint welding procedures by tests as specified in AWS D1.1, Part B, for welded connections.

1. Pre-qualified welding procedures conforming to AWS D1.1, Sections 2, 3, 4, and 8, shall be deemed pre-qualified and exempt from qualification tests.
2. Joint welding procedures and qualification tests shall be prepared by the joist manufacturer written welding procedures shall be made available to testing agency for use or examination.

D. Continuously weld shop and field connections in compliance with AWS D1.1, Structural Welding Code – Steel**,** unless bolted connections are specifically shown.

E. Visually inspect welds prior to priming joists. Welds shall be deemed acceptable if, by testing agency's visual inspection, welds meet or exceed the following standards for quality:

1. Acceptance standards for quality of welds on joists welded in compliance with SJI standards:

a. Weld has no cracks.
b. Through fusion exists between adjacent layers of weld metal and between weld metal and base metal.
c. Unfilled weld craters may occur at end of welds, but shall not be included in design length of welds.
d. Undercuts shall not exceed 1/16-inch, provided they are oriented parallel to the lines of principal stress.

e. Sum of surface (piping) porosity diameters shall not exceed 1/16-inch in any 1 inch of design weld length for fillet welds and partial penetration groove welds. Complete joint penetration groove joints transverse to the direction of computed tensile strength shall show no signs of visible piping porosity.
f. Weld profiles for fillet welds may be slightly convex or concave and free from excessive overlap.
g. Flare-bevel groove welds shall be filled flush to solid section of bar and free from excessive overlap.

2. Acceptance standards for quality of welds on joists welded in compliance with AWS D1.1:

a. Welds shall meet weld quality standards specified in AWS D1.1, Section 8.15.
b. Provide size, length, and type of welds as specified on shop drawings.

F. Repair unacceptable welds in compliance with repair procedures of AWS D1.1, Section 3.

2.3 FINISHES

A. Shop priming: Do not prime joists until they have been inspected, including all welds, by the testing agency.

B. Clean surfaces of loose mill scale, rust, welding slag, and other foreign materials prior to painting.

C. Apply paint in minimum one-mil DFT coats by spraying or dipping to produce a finish coat free from excessive drips, sags, or runs.

D. Do not stack or bundle joists until paint is dry.

2.4 SOURCE QUALITY CONTROL

A. Performance testing: Performance load tests are required of joist fabricator where any applicable design feature is not specifically covered by SJI specifications, including joists designed with sloped end bearing (slope exceeding 1/2-inch in 12 inches) and joists with non-parallel chords. Joists shall be considered as passing the load test if permanent deflection does not exceed 20 percent of total deflection as described below.

1. Testing laboratory shall select 2 joists at random, during fabrication, for load testing.
2. Joists shall be mocked-up in test assembly as they are to be erected in structure, except joists that are sloped in structure may be tested in a horizontal plane with test supports sloped the same as joist and bearing seats.
3. Joist shall have bridging and top decking applied. Bridging shall terminate at fixed supports as used in structure.
4. End bearing seats shall be connected to seat supports as detailed in structure.
5. Total test load shall consist of dead load plus 1.65 times design live load.
6. Test load shall be applied uniformly distributed in 2 increments:

a. A dead load equal to specified dead load shall be applied (weight of test panel, including joist, is included in dead load). Additional load shall be applied to equal specified design dead load. Zero reference measurements, for deflection, are to be made after dead load is in place.

b. Additional load shall be applied as required to equal 1.65 times the live load of each joist. Design live load shall be live load indicated on structural drawings.

7. Total test load shall remain in place for 1 hour. Deflection measurement at midspan, for both joists, shall then be recorded. Measured deflection is total deflection.

a. Test live load shall then be removed, but dead load shall remain in place.
b. Deflection measurement at midspan of each joist shall be recorded. This measured deflection will be the permanent deflection referred to above.

B. Fabricator's inspection: The fabricator shall inspect joists to ensure fabrication is in compliance with Contract Drawings and Specifications, the shop drawings and the following.

1. Maintain a quality control manual containing fabrication tolerances (sweep, camber, depth, length, locations of components, tolerances, etc.). Manual shall be made available to testing agency for its review and use.
2. At suitable intervals, observe joint preparation assembly practices, welding techniques, and performance of welding to determine that welding work is being performed in compliance with written welding procedures.

a. Visually inspect welds to determine that size, length, and location are in compliance with shop drawings and details of welded connections.
b. Visually inspect welds to determine that weld quality is in compliance with specified requirements.

3. Randomly check joists for overall length, depth, camber, sweep, size of components, locations, and materials, etc. to determine that dimensions conform to tolerances specified herein and with fabricator's quality control manual.
4. Visually inspect shop-priming operations to determine if appearance is in compliance with finish requirements.
5. Randomly test paint thickness to determine shop primer meets required dry film thickness.

C. Testing agency inspection: During steel joist fabrication, testing agency shall perform the following inspections to ensure work is in compliance with Contract Drawings and Specifications, the shop drawings and the following.

1. Review of mill test reports to determine compliance with the Specifications.
2. Review of welder's qualifications to determine compliance with the Specifications.
3. At suitable intervals, observation of joint preparation, workmanship, technique, and welder's performance to verify that welding work is in conformance with welding procedures and is being performed in compliance with the Specifications.
4. Visual inspection of weld quality, and size and length of weld.
5. Visual inspection of painting operation.
6. Verification that those inspections required of fabricator have been performed and the results thereof have been reported.

D. The fabricator shall notify Contractor and testing agency at least 3 days prior to beginning shop fabrication, and shall issue reports of inspections to testing agency prior to shipping or delivery of joists.

E. The fabricator shall promptly comply with requests from the testing agency to correct deficiencies in materials and welding work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.

B. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 PREPARATION

A. Before erection, clean joists to remove foreign materials.

3.3 INSTALLATION

A. Install in accordance with the Contract Drawings, the joist manufacturer's recommendations, "Handling and Erection of Steel Joists and Joist Girders" published by SJI, the requirements of the authorities having jurisdiction and the following.

1. Install plumb, true, securely anchored, accurately aligned, with all required fastenings, accessories, etc., spaced as indicated on the Drawings.
2. During installation, exercise care to keep horizontal bending of the joists to a minimum.
3. Install joists camber up with lateral bracing as indicated.

    a. Provide erection bracing to hold joists true, plumb and in safe condition until permanent bracing and bridging is in place to form a structurally sound framing system.
    b. Erection and permanent bracing shall be installed, and components permanently and securely fastened, before the application of any loads to the joists.

B. Lifting: Hoist members into position with proper bracing and secured at designated lift points. Keep out-of-plane bending to a minimum.

C. Permanently fasten joists to supports with all bridging properly spaced and connected and anchors completely installed before placing construction loads on joists.

D. Cutting: Do not field-cut joists, or remove joist members, except as indicated or directed by the Architect.

E. Site tolerances:

1. Joists shall be installed within 1/4-inch of true position.
2. Align joists to receive finished surfaces so the difference in plane between adjacent members is 1/8-inch or less at any point.

3.4 FIELD QUALITY CONTROL

A. Temporary construction loads that cause member deflections or stresses beyond design limits are not permitted.

B. Manufacturer shall conduct periodic on-site inspections of installation operations to verify the joist manufacturer's recommended procedures are being followed.

3.5 PROTECTION

A. Protect joists in place during the construction period protection when no longer needed.

B. Paint touchup: After installation is complete, touchup damaged shop-primer with the same paint used for shop painting.

1. Wire brush surfaces to bright metal and clean with solvent before painting.
2. Treat field welds, bolts and nuts, and rust spots as specified above.

C. Remove and replace materials that are damaged, loose, corroded, or that do not match adjacent materials or cannot be satisfactorily repaired, as determined and directed by the Architect, at no cost to the Owner.

END OF SECTION 052000

SECTION 053000 - METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:

1. Steel decking.
2. Accessories, filler pieces and metal closure pieces.

B. Related work in other Sections:

1. Section 051200 – Structural Steel
2. Section 055000 – Metal Fabrications
3. Section 050300 – Hot Dip Galvanizing
4. Section 033000 – Cast-in-place Concrete

1.2 SUBMITTALS

A. Procedure: In accordance with Division 1.

B. Dimensioned shop drawings showing section profiles, trim, detailed layout showing type and gage of steel decking, openings, sump pans (when applicable), supports, connections, welds and erection instructions. Identify welds by the AWS welding symbols. Indicate temporary shoring of decking where required.

C. Manufacturer's calculations and supporting data demonstrating that each metal deck proposed for use conforms to the Drawings, these Specifications and the Building Code.

D. Manufacturer's Installation instructions indicating specific installation sequence and special instructions.

1.3 QUALITY ASSURANCE

A. Welders' qualifications:

1. Welding shall be done only by welders currently certified for welding of light gage metal.
2. Qualification of welders and duration of qualification period in compliance with applicable requirements of AWS D1.3. Recertify and replace, with qualified welders, welders producing unsatisfactory welds, even though they have passed qualification tests.
3. Testing for recertification is Contractor's responsibility.

B. Design criteria:

1. Fire rating: Be responsible for obtaining UL and Building Department approval of the decking, when used as a part of the assembly indicated on the Drawings in which fire resistive construction ratings are required.

2. Design: In compliance with the following reference standards.

    a. SDI, Design Manual for Composite Decks, Form Decks and Roof Decks.
    b. AISI, Specification for the Design of Cold-Formed Steel Structural Members, and AISC, Manual of Steel Construction.

C. Shoring: Unless noted otherwise on the Drawings, the decking doesn't require shoring, except that when the weight of the wet concrete fill is expected to exceed the deck manufacturer's published data for safe capacity and allowable deflection. The Contractor shall determine these locations and provide temporary shoring until concrete fill has attained its 28-day strength.

1.4 HANDLING

A. Procedure: In accordance with Section 016000.

B. Labeling: Label each unit or bundle of metal decking, which is UL classified, to show manufacture, testing and Inspection.

C. Protection: Work showing dents, creases, burrs in cells, deformations, weathering or other defects affecting its use will not be accepted.

D. Storage: Store units off the ground with one end elevated to permit drainage. In wet or damp weather, cover with waterproof tarpaulins to avoid rusting.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel for decking and closure strips: ASTM A 653, with minimum yield strength of 33,000 psi, with a G 60 zinc coating.

B. Miscellaneous steel shapes: ASTM A 36.

C. Galvanizing repair paint: Tneme-Zinc 90-97 by Tnemec Co., Amercoat 68HS by Ameron Protective Coating Division, or MZ-4 by Valspar Corp.

D. Welding rods:

1. Complying with the printed recommendations of the metal deck manufacturer and AWS D1.1.
2. Submit the manufacturer's recommendations to the Architect prior to starting the installation.

2.2 FABRICATION

A. Decking:

1. Of the types and profiles indicated on the Drawings formed in lengths to span 3 or more supports, unless otherwise indicated, with flush, telescoping, or nested ends, end laps and nesting side laps.
2. Composite decking shall have either mechanically fixed shear devices such as embossments, holes or welded buttons, or inverted triangular shaped ribs.
3. Fabricate decking supporting waterproofing membrane, roofing and elastomeric coating with vent tabs protruding and staggered in the low flutes, 12 in. maximum o.c., or other joint deformation, to provide a minimum 1.5% openings (uniformly distributed) of the total deck area for relief of vapor pressure; do not use vent tabs to support mechanical equipment.

B. Form end closures, column flashing, access hole covers and cover plates of sheet metal.

C. Hangers for suspended ceilings:

1. Lip tabs or integral tabs. Nothing shall be hung from metal decking itself or from tabs punched directly in metal decking.
2. Provide slots or holes punched in decking for installation of pigtail wires.

D. Form roof sump pans from a single piece of galvanized sheet steel of same quality as deck units.

1. Thickness shall be a minimum of 14 gage before galvanizing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive steel decking and associated work and conditions under which work will be installed. Do not proceed until satisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of the work within a particular area will be construed as installer's acceptance of surface conditions.

3.2 INSPECTION

A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

3.3 INSTALLATION

A. Install decking and accessories in compliance with their manufacturer's recommendations and the approved shop drawings.

B. Coordinate and cooperate with other trades in locating decking bundles to prevent overloading of structural framework.

C. Place decking on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting steel supports not less than 2in. before fastening permanently.

D. Do not stretch or contract side lap interlocks. Place decking in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting deck units,

E. Cut and fit decking and accessories around other work projecting through or adjacent to the decking as shown on the Drawings. Provide neat, square and trim cuts.

F. Place roof sump pans over openings in steel deck and weld to top decking surface.

1. Space welds at 12" o.c. maximum with a minimum of one weld at each corner.
2. Cut opening in bottom of pan for roof drain accurately.

G. Do not use decking for storage or working platforms until permanently secured.

1. Coordinate protection and bracing of metal decking used as runway for transporting concrete.
2. Verify that decking manufacturer's directions for protection are followed.

3.4 FASTENING

A. Side joints: Fasten interlocking side closures as noted on the Drawings.

3.5 OPENINGS

A. Provide openings required for work of other trades and which are not indicated on Drawings only upon approval of the Architect as to size, location and reinforcement. The cost of such openings and reinforcement for same shall be home by the Contractor.

B. Provide additional steel reinforcement and closure pieces as required for strength, Continuity of decking and support of other work as shown.

C. Reinforce openings as Indicated on the Drawings.

D. Fabricate metal closure strips, for openings between decking and other construction, of sheet steel of same quality as deck units. Form to configuration required to provide tight-fitting closures at open ends of cells of flutes and sides of decking.

1. Adjusting plates: Provide in locations too narrow to accommodate full-size deck units and install as recommended by the deck manufacturer and approved on the shop drawings.
2. End closures: Provide metal cover plates or joint tape at joints between decking sheets to be filled with concrete to prevent concrete leakage.
3. Column flashing: Provide between floor decking and columns which penetrate the deck. Field cut flashing to fit, and tack weld to decking and columns.
4. Access hole covers: Provide to seal holes cut in decking to facilitate welding of decking to structural supports.

3.6 ATTACHMENTS

A. Coordinate location, spacing and type of connections required to attach wood nailers, suspended ceilings and similar items to decking.

B. Drill decking as shown and as required by approved shop drawings.

3.7 CLEANING AND TOUCHING-UP

A. Remove slag from welds, clean to bright metal and touch-up with zinc-rich paint; also clean and touch-up with zinc-rich paint raw edges of deck cut for openings.

B. Welds over which concrete fill will be placed need not be slagged and painted.

3.8 FIELD QUALITY CONTROL

A. The Testing Agency employed by the Owner will inspect, and test where applicable, all field welding.

1. Testing Agency will furnish qualified inspectors.
2. Tests and inspections shall comply with Code requirements, as amended by Building Department regulations.
3. Testing Agency will inspect welds visually when operators are making welds at commencement of this work and after this work is completed, for penetration of weld metal, fusion, and general ability of operator. Defective welds shall be corrected in compliance with applicable provisions of AWS D1.1.
4. Testing Agency will be required to confirm welder's qualifications and to certify in writing upon completion of this work that the welding has been performed in compliance with Drawings and Specification requirements, Including the use of AWS qualified procedures, the manufacturer's recommended use of automatic equipment, and the use of preheat, if required, and with all applicable requirements of regulatory agencies having jurisdiction.

B. The Testing Agency will report on the results of the inspection.

C. In addition to the survey required of the structural steel frame In Section 05120, the Contractor's surveyor shall also provide a survey of the steel decking, to verify dimensions, elevations and tolerances. Deck edge closure strips shall be within 1/4 in. of the theoretical location shown on the Drawings.

END OF SECTION 053000

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Includes:

1. Contractor engineered, fabricated, and installed cold-formed steel stud framing systems for support of decorative elements, Portland cement plaster walls, doors, etc., installed therein, complete with all required accessories.
2. Backing plates not provided by other trades for support of items attached to conformed metal framing.
3. Provide all supplementary parts and components, such as inserts, clips, bracing and other miscellaneous supports required for a complete installation.

B. Work furnished but installed in other Sections includes:

1. Inserts and other structural anchorage provisions, exterior walls, etc.

1.2 QUALITY ASSURANCE

A. Fabricator/Installer qualifications: Fabricator/Installer shall have completed cold-formed steel stud framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance. Fabricator/installer shall assume responsibility for engineering cold-formed metal framing by employing a State of California licensed Structural Engineer to prepare and seal design calculations, shop drawings, and data.

B. Testing agency qualifications: Conforming to requirements of ASTM E 699, and that it has experience and capacity to conduct required testing without delaying Work.

C. Welding Standards: AWS D1.1 "Structural Welding Code--Steel" and AWS D1.

D. "Structural Welding Code--Sheet Steel."

1. Welder’s certification: Each welder shall have passed AWS qualification tests for type of welding processes required for this Project within last 12 months, and if required has undergone recertification. Welders shall be certified by the local Building Official for light gage welding

E. Fire-rated construction: Provide cold-formed steel stud framing identical to that tested as part of an assembly for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to governing authorities having jurisdiction, and as indicated by design designation listed in UL "Fire Resistance Directory," or by equivalent Warnock Hersey or another testing and inspecting agency acceptable to governing authorities having jurisdiction.

F. Professional engineer qualifications: Professional Structural Engineer legally authorized to practice in the State of California, and with successful experienced in providing engineering services for work of similar scope and complexity.

G. Reference standards:

1. AISI Specifications - "Specification for the Design of Cold-Formed Steel Structural Members", latest edition.
2. Center for Cold-Formed Steel Structures (CCFSS) Technical Bulletin, Vol. 2, No. 1, February 1993 "AISI Specification Provisions for Screw Connections."
3. ASTM Standard C955 – “Standard Specification for Load Bearing (Transverse and Axial) Steel Studs, and Bracing or Bridging for Screw Application of Gypsum Board or Metal Plaster Bases”.
4. ASTM Standard C1007 – “Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories”.

H. Structural Performance: Design, engineer, fabricate, and erect cold-formed steel stud framing to withstand design loads within limits and under conditions required by the Building Code, but in no case less than 30 psf.

I. Deflection: Lateral deflection of L/360 under full design load.

J. Movement: Make all necessary provisions for movement of framing members without damage to finishes and substrates attached to them, failure of connections, undue strain on fasteners, or other detrimental effects when subjected to a maximum ambient temperature range of 120 deg. F.

K. Deflection of primary building structure: Design framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.

L. Structural General Notes: The applicable Structural General Notes shall apply to the work of this Section as though repeated verbatim herein.

M. Mock-ups: Provide full size mock-ups of special areas and/or shapes of cold-formed metal framing, as directed by Architect.

1.3 SUSTAINABLE PROJECT REQUIREMENTS

A. Comply with the requirements of Section 01351, Sustainable Project Requirements, and the LEED V 2.0 Registered Project Checklist.

1.4 SUBMITTALS

A. Make submittals in accordance with the requirements of Section 013300.

B. Product data: Submit product data for each type of cold-formed steel stud framing, accessory, and product specified.

C. Shop drawings: Submit shop drawings showing layout, spacing, sizes, gages, and types of cold-formed steel stud framing, fabrication, fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachments adjacent work.

1. Include setting drawings, templates, and directions for the installation of anchor bolts and other anchorages installed as a unit of work under other sections.
2. Indicate any proposed deviations from Architect's intent.
3. Shop drawings shall be signed and sealed by a Structural Engineer registered in the State of California, along with a written statement that the wall system conforms to project requirements, applicable codes, and specified conditions.

    a. In addition provide for information only, material properties and other information needed for structural analysis including computations, prepared, signed, and sealed by a State of California registered Structural Engineer.

D. Test reports: Submit test reports from qualified independent testing agency evidencing compliance with requirements.

E. Welder certificates: Submit welder certificates signed by Contractor certifying that welders comply with requirements specified in Article 1.2.

F. Qualifications: Submit qualification data for installer as specified in Article 1.2. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Building Code compliance: Submit evidence, including research or evaluation reports showing that proposed cold-formed metal framing is in compliance with applicable Building Code requirements.

H. Recycled content submittals: As specified in Article 1.3 above.

1.5 PRE-INSTALLATION MEETING

A. Representatives of the following parties shall hold a jobsite conference before this work is started:

1. Architect.
2. Contractor.
3. Hollow metal doors and frames installer.
4. Glazed aluminum framing installer.
5. Portland cement plaster applicator.
6. Gypsum sheathing installer.

B. Attendees shall review all pertinent drawings and specifications, noting any potential problems and making any changes, deletions or additions deemed necessary, and determine the availability of specified materials, submittal requirements, scheduling, and additional items pertaining to this work.

C. Attendees shall view surfaces receiving cold-formed metal framing and determine their suitability to receive the specified materials.

D. Discussion shall be recorded, including agreement or disagreement on matters of significance. If the meeting ends with substantial disagreements, it shall be determined how disagreements will be resolved, and a date set for another meeting if required.

1.6 SYSTEM DESCRIPTION

A. The cold-formed steel stud framing fabricator shall be responsible for structural design and engineering required to meet specified performance requirements within physical and aesthetic requirements established.

B. Requirements specified or indicated on the Drawings are intended to establish aesthetic design requirements and performance of exterior and interior finish materials.

C. Drawings do not necessarily indicate or describe total work required for completion of Work. Provide all work required for complete installation.

D. Dimension and profile adjustments may be made in proposed structural design in the interest of fabrication or erection methods or techniques, weatherability factors or ability of system to satisfy design and performance requirements, provided that aesthetic design intent and intent are maintained. Include modifications or additions required to meet specified requirements and maintain the visual design concept.

1.7 HANDLING

A. Store materials undercover, off the ground or floor, in a dry, ventilated space.

PART 2 - PRODUCTS

2.1 FINISHES

A. General: Cold-formed metal framing shall be galvanized.

B. Fabricate galvanized studs and furring from galvanized sheet steel complying with ASTM A653, with minimum protective coating equal to G-60 galvanized finish. Hot-dip galvanize inserts and channels in accordance with ASTM A123.

C. Materials specified hereafter by weight do not include the weight of protective finishes.

2.2 MATERIALS

A. Studs:

1. Of the sizes indicated on the Drawings by Western Metal Lath, Co., Cemco, Angeles Metal Systems, or equal, however the minimum stud gage acceptable is as called for on the Drawings.
2. Studs shall comply with the following, as applicable:

a. ASTM C955 - Specifications for Load Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases, for Load Bearing studs.
b. ASTM C645 - Specifications for Non-Load (Axial) Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board, where applicable for non-load bearing interior gypsum board studs.

c. Studs supporting metal lath shall have a minimum flange width of 1/2". Studs supporting gypsum sheathing shall have a minimum flange width of 1-3/8".
d. Where the wall finish does not adequately brace both flanges of studs, bracing shall be added or allowable stresses shall be reduced in computing stud heights in accordance with UBC and AISI requirements.

3. Provide all necessary shoes, clips, ties, stiffeners, fasteners, door jamb reinforcements, and other accessories recommended by the manufacturer for the conditions of use.

B. Top and bottom runner tracks and bridging: As indicated on shop drawings.

C. All structural framing accessories shall be formed from structural quality steel with minimum yield strength of 33 KSI and have minimum protective coating equal to G-60 galvanized finish.

D. Fasteners:

1. Screws: As indicated on shop drawings, and complying with applicable requirements of the building code for each condition of use.
2. Welding electrodes: ASTM A233, as recommended by AWS for the conditions of use and the metals to be welded.

2.3 FABRICATION

A. Cold-formed metal framing may be shop or field fabricated into assemblies, prior to erection, or stick built in the field.

B. Structural members shall be sized, spaced and erected in accordance with the shop drawings and calculations signed and sealed by the fabricator's Structural Engineer.

C. Structural framing shall have ends squarely cut by shearing or sawing, and shall be installed plumb, square, true to line, and securely fastened in accordance with the shop drawings.

D. Fabrication, handling, and erection of the structural framing and assemblies shall be done in a manner to prevent any damage or distortion of the framing.

E. Cold-formed tracks when set to adjacent structures, shall have web contact with a uniform and level bearing surface, and shall be securely anchored with fasteners of size and spacing indicated on shop drawings.

F. No cutouts or splices permitted in the flanges of axial loaded studs.

G. Framing for wall openings shall include jack studs, headers, cripples, sill plates, and jamb studs as indicated on the Drawings and shop drawings.

H. Where structural framing at thermally insulated walls forms box sections at headers, jambs, etc., the voids shall be filled with suitable insulation prior to assembly. Coordinate with work of Section 072100.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

3.2 PREPARATION/COORDINATION

A. Installation of cold-formed metal framing shall be coordinated with structural steel and concrete work to ensure that inserts and other structural anchorage provisions are installed at correct locations.

3.3 INSTALLATION

A. General: Erect cold-formed metal framing in accordance with its manufacturer's printed recommendations, the reference standards, the Drawings and these Specifications.

1. Do not attach metal framing nor suspension wires to ducts, conduits or pipes.
2. Cut framing components squarely for a tight fit against abutting members. Erect framing plumb and level to provide solid backing for finish materials. Install all steel studs so that their flanges point in the same direction.
3. Do not exceed 1/8" in 10 ft. tolerance from true lines and levels nor 1/4" from true position. Perform remedial work on framing as necessary to achieve specified tolerances.
4. Provide additional framing where required to ensure that framing members fall behind exterior Portland cement plaster reveals and control joints. Provide double studs behind control joints.

B. Wall framing:

1. Align and securely anchor ceiling and floor tracks to building construction.
2. Anchor runners as indicated on the Drawings.
3. Provide metal shims as required by substrate conditions. No wood shims permitted.
4. Provide double studs, closer spacing, and additional reinforcement as detailed or required at door and window frames on other openings.
5. Install studs in single length, without joints, extending from floor to underside of floor or roof structure above. Splicing studs is not permitted.
6. Attaching studs to runner track:

    a. Except where indicated to be welded, attach studs to runner tracks with screws in accordance with the stud and top slip track manufacturer's printed instructions.
    b. Attach corner studs, studs on each side of door or window jambs and other openings in walls as indicated on the shop drawings.
    c. Weld studs where indicated on the shop drawings. Comply with AWS standards specified.
    d. Provide horizontal stiffeners where indicated on the shop drawings.
    e. Double cold formed metal framing members (face to face to form a tube adjacent to doors, windows and other openings, and attach securely to top and bottom track as specified in subparagraph 5.b. above, and to door head track with clip angles.

1) Locate additional studs not more than 2" from door and window frames, abutting partitions, partition corners, and other construction.
2) Install a section of track over door and window frames with a clip angle at each end and attach securely to the adjacent vertical studs.
3) Install cut-to-length studs at the location of vertical joints and at standard spacing over the door frame header extending to the ceiling track.
4) Provide additional framing, as required, for attachment of reveals, control joints, and similar items in stud walls.

C. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment, services, heavy trim, and similar work as indicated on the Drawings, the reference specifications, and in accordance with applicable requirements of the building code.

1. Backing plates: Plates not provided with fixtures and equipment shall be at least 11 gage X 4" wide and long enough to span across 3 studs. Notch studs for the thickness of the backing plate and weld plates continuously along all contact surfaces at each stud crossing.

D. Welding: Perform welding in accordance with AWS recommendations. Welders shall be qualified to weld cold-formed metal framing. Stitch plates may only be used where studs are burned through with written approval of the Contractor’s Structural Engineer.

E. Damaged zinc coating: Repair damaged areas by wire-brushing to bright metal and applying a zinc-rich paint applied in multiple coats to dry film thickness of 4 mils.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included:

1. Metal fabrications whether or not specifically mentioned herein or in other sections of these specifications, but which are required to complete the work, 12 gage or heavier.
2. Bolts, washers, brackets, sleeves, angles, clips, etc., required in assembly, erection and securing the work of this Section.
3. Elevator hoistway dividers.

B. Products furnished but not installed under this Section: Metal fabrications installed in concrete and masonry.

C. Related work:

1. Security gates and fences.
2. Structural steel.
3. Metal stairs.
4. Aluminum railings.
5. Painting, except shop prime coats.
6. Hot-dip Galvanizing

1.2 QUALITY ASSURANCE

A. Comply with requirements of Section 014000.

B. Railings:

1. Structural performance of handrails and railing systems: Engineer, fabricate and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.

   a. Top rail of guardrail systems: Capable of withstanding a uniform load of 20 pounds per lineal foot (at private balconies) and 50 pounds per linear foot (at public areas) per lineal foot applied horizontally at right angles to the top rail and concentrated load of 250 pounds applied in any direction at any point on the rail.
   b. Infill area of guardrail systems: Capable of withstanding the following loads applied as indicated:

      1) Concentrated load of 25 pounds per square foot applied horizontally at right angles over the entire tributary area, including openings and spaces between rails.

2) Reactions due to the above load need not be combined with those loads on the toprail of guardrail system.
3) Wind loads as required by Building Code.

c. Handrails: The mounting of handrails shall be such that the completed handrail and supporting structure are capable of withstanding the following loads:

1) Concentrated load of 250 pounds applied in any direction at any point on the handrail.
2) These loads shall not be assumed to act cumulatively with those loads on the infill area of the guardrail system.

2. Thermal movement: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating and installing of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculations on actual surface temperatures of materials due to both solar heat gain and night time sky heat loss. Temperature change (range): 120 deg. F ambient; 180 deg. F material surfaces.
3. Control of corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
4. Railings shall be free of rattles.

C. Standards:

1. American Institute of Steel Construction, Inc. (AISC):

a. "Manual of Steel Construction", Third Edition.
b. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
c. "Code of Standard Practice for Steel Buildings and Bridges".
d. "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

2. American Welding Society (AWS): "Structural Welding Code", D1.1.

1.3 SUBMITTALS

A. Comply with requirements of Section 013300.

B. Product data: Complete materials list showing items proposed to be provided under this Section.

C. Shop drawings: Submit layout drawings and details showing required material, gauges, accessories, openings, finishes, welding notes and all other conditions affecting the material and installation.

1.4 FIELD MEASUREMENTS

A. Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.5 SUSTAINABILITY REQUIREMENTS

A. LEED 2009 NC:

1. Recycled content.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel sections: ASTM A 36.

B. Steel tubing:

1. Cold-formed: ASTM A 500, Grade B.
2. Hot-formed: ASTM A 501.

C. Plates: ASTM A 283.

D. Pipe: ASTM A 53, Grade B, Schedule 40.

E. Bars and bar-size shapes: ASTM A 663, Grade 65 and ASTM A 675.

F. Carbon steel sheets and strips:

1. Hot rolled: ASTM A 568 and ASTM A 569.
2. Cold rolled: ASTM A 366.

G. Bolts, nuts, and washers: ASTM A 307.

H. Welding materials: AWS D1.1; type required for materials being welded.

I. Shop paint:

1. Primer: Manufacturer's standard.
2. For repair of galvanizing, use a high zinc dust content paint complying with DOD-P-21035 or SSPC-Paint 20.

2.2 MISCELLANEOUS FRAMING AND SUPPORT

A. Provide miscellaneous steel framing and supports as necessary to complete the work.

B. Fabricate units to the sizes, shapes and profiles indicated, or if not indicated, of the necessary dimensions to receive adjacent work to be retained by the framing.

C. Except as otherwise indicated, fabricate using mitered corners, welded brackets and splice plates and a minimum number of joints for field connections.

D. Equip units with integrally welded anchor straps for casting into cast-in-place concrete wherever possible.

E. Steel framing and supports for operable partitions, overhead doors, countertops, mechanical and electrical equipment applications where framing and supports are not specified in other Sections.

F. Miscellaneous items may include elevator safety beams, metal ladders, sump pit covers, loose bearing and leveling plates, etc.

2.3 FABRICATION

A. Fit and shop assemble in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured, true to line and level.

C. Weld corners and seams continuously. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed mechanical fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

F. Allow for thermal movement resulting from the maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss for a temperature range of 120 deg. F.

2.4 GALVANIZING

A. Comply with requirements of Section 050300.

B. Galvanize exterior steel members, bolts, nuts, washers, hardware, fabrications and assemblies after fabrication by the hot dip process.

C. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

D. Galvanize miscellaneous framing where indicated, including hydrotherapy pool pit ladders.

2.5 FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact bond with concrete or where field welding is required.

C. Prime and finish paint items where indicated and in compliance with requirements of Section 099000.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Clean and strip primed steel items to bare metal where site welding is required.

C. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.2 INSTALLATION

A. Erect items plumb, square and level, accurately fitted and free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated on reviewed shop drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain Architect's approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 DISSIMILAR METALS

A. When dissimilar metals come into contact or when aluminum components come into contact with cement or lime mortar, paint exposed aluminum surfaces with heavy bodied bituminous paint.

3.4 CLEAN AND PROTECT

A. Upon completion of installation, clean all work for inspection and approval. Clean aluminum with plain water containing a mild soap or detergent, or white gasoline kerosene or distillate. Do not use abrasive agents.

B. Protect all work from damage during the balance of construction.

3.5 SCHEDULE

A. Furnish and install metal fabrications listed herein for the locations shown, complete with anchorage and attachments necessary for installation.

B. The Schedule is a list of principal items only. Refer to Drawings for items not scheduled.

C. Steel pipe railings:

1. Standard weight black steel pipe, 1-1/2" outside diameter.
2. Standard wall brackets spaced not more than 5'-0" o.c.
3. Clear space between rail and wall shall be exactly 1-1/2".
4. Provide wall backing as necessary to support loads of 250 lbf in bending, shear and tension. Comply with requirements of Paragraph 1.02 B.
5. Extend rails, parallel to floor, 12" minimum beyond top riser nosing and one tread plus 12" beyond bottom riser nosing.
6. Return ends smoothly to wall.
7. Accurately form, cut, miter or cope joints and shape to fit various locations. Weld joints and grind smooth.
8. Shop finish:

    a. Exterior: Galvanize.
    b. Interior: Prime paint.

D. Steel guards:

1. Protect walls, ducts, pipes, conduits and equipment that could be damaged by vehicles. Verify required locations with Architect.
2. Shop finish:

    a. Exterior: Galvanize.
    b. Interior: Prime paint.

E. Manhole cover and frame:

1. Manufacturer: Alhambra Foundry Co., Ltd., (626) 289-4294.
2. Type: No. A-1254, 24" diameter clear opening, solid cover.

F. Steel backing plates: Provide steel backing plates necessary for engaging and fastening work of other trades, in locations indicated or necessary, except for backing plates specified to be provided under other Sections. Carefully coordinate precise locations with related trades. Securely weld to supporting members in precise location. Paint bare surfaces of plates and welds with metal primer after installation.

G. Steel strip ladders:

1. Fit rungs of strip ladders in centerline of side rails, plug weld and grind smooth on outer rail faces.
2. Support each ladder at top and bottom and at intermediate points spaced not more than 60" o.c. with welded or bolted steel brackets.
3. Provide nonslip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, by using a type of manufactured rung that is filled with aluminum-oxide grout or by coating with abrasive material metallically bonded to the rung by a proprietary process.
4. Shop finish:

    a. Exterior: Galvanize.
    b. Interior: Prime paint.
    c. In water-holding tanks: Organic coating complying with requirements of Section 05902.

H. Ledge and shelf angles:

1. Exterior and angles supporting cut stone veneer: Stainless steel.
2. Interior (except angles supporting cut stone veneer): Prime paint finish.

I. Custom fabricated frames, gratings and plate covers for hatches, catch basins, sumps or pits:

1. Shop finish:

a. Exterior: Galvanize.
b. Interior: Prime paint.

J. Miscellaneous steel shapes:

1. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.
2. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6" from each end, 6" from corners, and 24" o.c., unless otherwise indicated.
3. Shop finish:

a. Exterior: Galvanize.
b. Interior: Prime paint.

END OF SECTION 055000

SECTION 055013 – INTERIOR METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Elevator machine beams, hoist beams.
7. Steel shapes for supporting elevator door sills.
8. Metal ladders.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 055000 "Metal Fabrications" for exterior metal fabrications.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for operable partitions.

2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Elevator machine beams, hoist beams.
7. Steel shapes for supporting elevator door sills.
8. Metal ladders.

B. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

B. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

B. Structural Performance of Aluminum Ladders: Aluminum ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

2.2 METALS

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

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches.
2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0966-inch minimum thickness; unfinished.

2.3 FASTENERS

A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

B. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

D. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

F. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.

2.8 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION

SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with plywood-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. 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.

C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

B. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft.
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

    a. Uniform load of 50 lbf/ft. applied in any direction.
    b. Concentrated load of 200 lbf applied in any direction.
    c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

    a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    b. Infill load and other loads need not be assumed to act concurrently.

D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

2.2 METALS

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

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.6 STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel plates or channels.

    a. Provide closures for exposed ends of channel stringers.

2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they are concealed by concrete fill. Do not weld risers to stringers.
3. Shape metal pans to include nosing integral with riser.
4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

    a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.7 STAIR RAILINGS

A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-5/8-inch- diameter top and bottom rails and posts.
2. Picket Infill: 1/2-inch- round pickets spaced less than 4 inches clear.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:

1. As detailed.
2. By bending or by inserting prefabricated elbow fittings.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms.

3.2 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

END OF SECTION

SECTION 057000 - DECORATIVE METAL FINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following ornamental metal fabrications:

1. Exterior signage - "integral" fins.

1.3 REFERENCED STANDARDS

A. AAMA - American Architectural Manufacturers Association.

1. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM - American Society for Testing and Materials International.

1. ASTM B 26: Specification for Aluminum-Alloy Sand Castings.
2. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM B 221: Specification for Aluminum and Aluminum-Alloy Extruded.
4. ASTM B 247: Specification for Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
5. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
6. ASTM E 488: Test Method for Strength of Anchors in Concrete and Masonry Elements.

C. AWS - American Welding Society.

1. AWS D1.2: Structural Welding Code - Aluminum.

D. CFR - Code of Federal Regulations.

1. 40 CFR 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.

E. NAAMM - National Association of Architectural Metal Manufacturers.

1. Metal Finishes Manual for Architectural and Metal Products.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including finishing materials.

B. Shop Drawings: For ornamental metal. Include plans, elevations, component details, and attachments to other work. Indicate materials and profiles of each ornamental metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. Provide load calculations by licensed engineer for State of California requirements.

C. Samples: For products involving selection of color, texture, or design including mechanical finishes.

1. Mock-Up: Provide 5'-0" x 5'-0" mock-up as directed by Architect

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Arrange for installation of ornamental metal specified in this Section by the same firm that fabricated it.

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

C. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to aluminum extrusions and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

D. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store ornamental metal inside a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

B. Deliver and store cast-metal products in wooden crates surrounded by sufficient packing material to ensure that products will not be cracked or otherwise damaged.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with ornamental metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate installation of anchorages for ornamental metal items. 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.

PART 2 - PRODUCTS

2.1 ORNAMENTAL METAL FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide ornamental metal work by the following:

1. Local Fabricators as approved by Architect.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.3 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Aluminum Tubes:

1. Profile - As indicated on Drawings.
   a. Provide caps at all open extrusions.
   b. Metal spacers to be 'Black', unless otherwise indicated.

2. Thickness: 0.125 inch (3 mm) minimum.

C. Extruded Bars and Shapes: ASTM B 221, Alloy 6063-T5/T52.

D. Plate and Sheet: ASTM B 209, Alloy 3003-H14.

E. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

F. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.4 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Aluminum Items: Aluminum fasteners.
2. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Provide concealed fasteners for interconnecting components and for attaching ornamental metal items to other work, unless otherwise indicated.

D. Anchors: Provide cast-in-place chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION, GENERAL

A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

C. Form ornamental metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form simple and compound curves in bars and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

F. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.8 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

G. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.

H. Provide weep holes where water may accumulate.

I. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items, unless otherwise indicated.

J. Comply with AWS for recommended practices in shop welding and brazing. Weld and braze behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.

K. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of ornamental metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure ornamental metal to in-place construction.

B. Perform cutting, drilling, and fitting required to install ornamental metal. Set products accurately in location, alignment, and elevation; measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of ornamental metal, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.

F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.

H. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Protect finishes of ornamental metal from damage during construction period with temporary protective coverings approved by ornamental metal fabricator. Remove protective covering at time of Substantial Completion.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057000

SECTION 057313 - GLAZED DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass- supported railings.
2. Post-supported railings.

1.2 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.3 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.

B. Coordinate installation of anchorages for railings. 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 items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Metal Works.
2. Architectural Railings & Grilles, Inc.
3. ATR Technologies, Inc.
4. Julius Blum & Co., Inc.
5. CraneVeyor Corp.
6. C. R. Laurence Co., Inc.
7. Livers Bronze Co.
8. Newman Brothers, Inc.
9. P & P Artec.
10. TACO Metals Inc.
11. Tri Tech, Inc.
12. Wylie Systems.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
2. Stainless Steel: 60 percent of minimum yield strength.

3. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Extruded Bars and Shapes: ASTM B 221, Alloy 6063-T5/T52.

C. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

D. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304.

C. Sheet, Strip, Plate, and Flat Bar: ASTM A 666 or ASTM A 240/A 240M, Type 304.

D. Bars and Shapes: ASTM A 276, Type 304.

2.6 GLASS AND GLAZING MATERIALS

A. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.

B. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.

1. Glass Color: Clear.
2. Thickness for Structural Glass Balusters: As required by structural loads, but not less than 12.0 mm.

C. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacture]. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.

1. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.

2.7 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Aluminum Components: Type 304 stainless-steel fasteners.
2. Stainless-Steel Components: Type 304 stainless-steel fasteners.
3. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.8 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.9 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

H. Form changes in direction as follows:

1. As detailed.

I. Close exposed ends of hollow railing members with prefabricated end fittings.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.

K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.10 GLAZING PANEL FABRICATION

A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.

B. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.

2.11 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.12 ALUMINUM FINISHES

A. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.13 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

3.3 ANCHORING POSTS

A. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.4 INSTALLING GLASS PANELS

A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.

1. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement unless glass was bonded to base and top-rail channels in factory.

a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.

2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

3.5 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.

B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 057399 - GLAZED DECORATIVE METAL RAILINGS (EXTERIOR)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior glass-supported railings.
2. Exterior post-supported railings.

1.2 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.3 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.

B. Coordinate installation of anchorages for railings. 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 items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Metal Works.
2. Architectural Railings & Grilles, Inc.
3. ATR Technologies, Inc.
4. Julius Blum & Co., Inc.
5. CraneVeyor Corp.
6. C. R. Laurence Co., Inc.
7. Livers Bronze Co.
8. Newman Brothers, Inc.
9. P & P Artec.
10. TACO Metals Inc.
11. Tri Tech, Inc.
12. Wylie Systems.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
2. Stainless Steel: 60 percent of minimum yield strength.

3. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Extruded Bars and Shapes: ASTM B 221, Alloy 6063-T5/T52.

C. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

D. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 STAINLESS STEEL

A. Tubing: ASTM A 554, Grade MT 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304.

C. Sheet, Strip, Plate, and Flat Bar: ASTM A 666 or ASTM A 240/A 240M, Type 304.

D. Bars and Shapes: ASTM A 276, Type 304.

2.6 GLASS AND GLAZING MATERIALS

A. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.

B. Tempered Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials.

1. Glass Color: Clear.
2. Thickness for Structural Glass Balusters: As required by structural loads, but not less than 12.0 mm.

C. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacture]. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.

1. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.

2.7 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Aluminum Components: Type 304 stainless-steel fasteners.
2. Stainless-Steel Components: Type 304 stainless-steel fasteners.
3. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.8 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.

2.9 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

H. Form changes in direction as follows:

1. As detailed.

I. Close exposed ends of hollow railing members with prefabricated end fittings.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.

K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.10 GLAZING PANEL FABRICATION

A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.

B. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.

2.11 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.12 ALUMINUM FINISHES

A. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.13 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

3.3 ANCHORING POSTS

A. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.4 INSTALLING GLASS PANELS

A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.

1. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement unless glass was bonded to base and top-rail channels in factory.

a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.

2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

3.5 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.

B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057399

SECTION 057500 - DECORATIVE FORMED METAL

1.1 SUSTAINABILITY REQUIREMENTS

A. LEED 2009 NC:

1. Recycled content.

1.2 PERFORMANCE REQUIREMENTS

A. Engineering design of exterior items by Contractor.

1.3 MATERIALS

A. Decorative-Metal-Clad Doors and Frames: Titanium finished textured Stainless-steel.

1. Basis of Design Manufacturer/Product: Forms & Surfaces; fused white gold, texture selected from Manufacturer’s standard textures.

B. Decorative-Metal-Ceiling Elements: Titanium finished textured Stainless-steel.

1. Basis of Design Manufacturer/Product: Forms & Surfaces; fused white gold, texture selected from Manufacturer’s standard textures.

C. Decorative-Metal-Casework Elements: Titanium finished textured Stainless-steel.

1. Basis of Design Manufacturer/Product: Forms & Surfaces; fused white gold, texture selected from Manufacturer’s standard textures.

1.4 FINISHES

A. Stainless Steel: Custom, as indicated.

END OF SECTION 057500

SECTION 057513 - DECORATIVE METAL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Facade screen panel.
2. Sponsorship Sign - Coordinate with Owner.

1.3 REFERENCED STANDARDS

A. ASTM - American Society for Testing and Materials International.

1. ASTM A 123: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A 153: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
5. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
6. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
7. ASTM C 920: Specification for Elastomeric Joint Sealants.
8. ASTM D 1056: Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
9. ASTM D 1187: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
10. ASTM E 136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C.
11. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements.

B. NAAMM - National Association of Architectural Metal Manufacturers.

1. Metal Finishes Manual for Architectural and Metal Products.

C. SSPC - SSPC: The Society for Protective Coatings.

1. SSPC-PA 1: Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.
2. SSPC-Paint 20: Paint Specification No. 20: Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").

3. SSPC-SP 3: Surface Preparation Specification No. 3: Power Tool Cleaning.
4. SSPC-SP 6/NACE No. 3: Joint Surface Preparation Standard SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Loads: Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved, including anchors and connections, and without exhibiting permanent deformation in any components:

1. Wind Loads on Exterior Items: 20 lbf/sq. ft. (957 Pa).

B. Thermal Movements: Provide exterior ornamental formed-metal assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Corrosion Control: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated, including finishes.

B. Shop Drawings: Detail fabrication and installation of ornamental formed metal. Include plans, elevations, sections, and details of components and their connections. Show anchorage and accessory items.

1. Calculations: Provide load calculations by licensed engineer for State of California requirements.

C. Samples: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, including mechanical finishes, and patterns available for each type of ornamental formed-metal product indicated.

1. Mock-Up: Provide 5'-0" x 5'-0" mock-up as directed by Architect.

1.6 QUALITY ASSURANCE

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

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver ornamental formed-metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with ornamental formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate installation of anchorages for ornamental formed-metal items. 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.

B. Coordinate installation of ornamental formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

PART 2 - PRODUCTS

2.1 METAL PANEL AT "SCREEN PANEL - SPONSOR SIGN"

A. Metal Grill (Painted PNT-01):

1. Basis-of-Design Product: Orsogril; Britosterope, 5-3/16 inches (131 mm) height by 2-7/16 inches (62 mm) or equal as approved by Architect.

a. Refer to Drawings: A-312's.

B. Expanded Metal (Painted PNT-01):

1. Basis-of-Design Product: McNichols; Expanded Metal, 1-1/2 inches (38 mm).

a. Refer to Drawings: A-312's.

C. Metal Grill (Sand Pit):

1. Basis-of-Design Product: McNichols; Galvanized Steel Bar Grating, 3/4 by 3/16 inch (19 by 5 mm) at 1-3/16 inches (30 mm) center to center spacing.

a. Refer to Drawings: A-313's.

2.2 SHEET METAL

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

2.3 MISCELLANEOUS MATERIALS

A. Gaskets: As required to seal joints in ornamental formed metal and remain weathertight; and as recommended in writing by ornamental formed-metal manufacturer.

1. ASTM D 1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
2. Closed cell polyurethane foam, adhesive on two sides, release paper protected.

B. Sealants, Exterior: ASTM C 920; elastomeric silicone, polyurethane, or polysulfide sealant; of type, grade, class, and use classifications required to seal joints in ornamental formed metal and remain weathertight; and as recommended in writing by ornamental formed-metal manufacturer.

C. Fasteners: Use fasteners fabricated from same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting ornamental formed-metal items and for attaching them to other work, unless otherwise indicated.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Structural Anchors: Provide chemical or torque-controlled expansion anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

E. Nonstructural Anchors: Provide powder-actuated fasteners, metal expansion sleeve anchors or metal impact expansion anchors of type, size, and material necessary for type of load and installation indicated, as recommended by manufacturer, unless otherwise indicated. Use nonferrous-metal or hot-dip galvanized anchors for exterior installations for corrosion resistance.

F. Backing Materials: Provided or recommended by ornamental formed-metal manufacturer.

G. Laminating Adhesive: Compatible with substrate; noncombustible after curing.

H. Isolation Coating: Manufacturer's standard epoxy coating.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble ornamental formed-metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Coordinate dimensions and attachment methods of ornamental formed-metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.

C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch (12 mm) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.

D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.

1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce ornamental formed-metal items as needed to attach and support other construction.

F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install ornamental formed-metal items.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of ornamental formed metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate and place ornamental formed-metal items level and plumb and in alignment with adjacent construction.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior ornamental formed-metal items weatherproof.

E. Corrosion Protection: Apply nonmelting/nonmigrating-type bituminous coating or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

A. Protect finishes of ornamental formed-metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 057513

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Preservative treatment of wood.
2. Fire retardant treatment of wood.
3. Rooftop equipment bases and support curbs.
4. Wood blocking, cants, and nailers.
5. Sustainable wood, recycled content, and low-emitting materials.

1.3 REFERENCED STANDARDS

A. ALSC - American Lumber Standard Committee, Inc.

B. APA - The Engineered Wood Association.

C. AWPA - American Wood-Preservers Association.

1. AWPA U1: Use Category System: User Specification For Treated Wood.

D. ASME - American Society for Mechanical Engineers International.

1. ASME B18.2.1: Square and Hex Bolts and Screws (Inch Series).
2. ASME B18.6.1: Wood Screws (Inch Series).

E. ASTM - American Society for Testing and Materials International.

1. ASTM A 153: Specification for Zinc-Coating (Hot-Dip) of Iron and Steel Hardware.
2. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
3. ASTM A 563: Specification for Carbon and Alloy Steel Nuts.
4. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
5. ASTM D 2898: Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
6. ASTM D 3201: Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products.
7. ASTM D 5664: Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber.

8. ASTM D 6841: Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber.
9. ASTM D 6007: Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber.
10. ASTM D 6330: Standard Practice for Determination of Volatile Organic Compounds (Excluding Formaldehyde) Emissions from Wood-Based Panels Using Small Environmental Chambers Under Defined Test Conditions.
11. ASTM E 84: Test Method for Surface-Burning Characteristics of Building Materials.
12. ASTM E 488: Test Methods for Strength of Anchors in Concrete and Masonry Elements.
13. ASTM E 1333: Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.
14. ASTM F 1667: Specification for Driven Fasteners: Nails, Spikes, and Staples.

F. DOC - U.S. Department of Commerce, National Institute of Standards and Technology.

1. DOC PS 1: U.S. Product Standard for Construction and Industrial Plywood.
2. DOC PS 20: American Softwood Lumber Standard.

G. FSC - Forest Stewardship Council.

H. ICC - International Code Council, Inc.

1. International Building Code.
2. ICC Evaluation Service, Inc.; NES NER-272: Pneumatic or Mechanically Driven Staples, Nails, P-Nails and Allied Fasteners for Use in All Types of Building Construction.

I. SPIB - The Southern Pine Inspection Bureau.

1. Standard Grading Rules for Southern Pine Lumber.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
5. Recycled Content Materials:

    a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
    b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.

c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

6. Local/Regional Materials:

a. Sourcing Location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
b. Manufacturing Location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

D. Letter of Certification(s) for Sustainable Forestry:

1. Forest Stewardship Council (FSC): Provide letter of certification signed by lumber supplier. Indicate compliance with FSC "Principles for Natural Forest Management" and identify certifying organization.

a. Submit FSC certification numbers; identify each certified product on a line-item basis.
b. Submit copies of invoices bearing the FSC certification numbers.

1.5 QUALITY ASSURANCE

A. Lumber: Comply with DOC PS 20 and approved grading rules and inspection agencies.

1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Sustainably Harvested Wood: Certification Organizations shall be accredited by the Forest Stewardship Council.

C. Recycled Content Materials: Where recycled lumber materials are used for structural applications, include lumber certification and quality grading.

D. Engineered Wood Products:

1. Determine formaldehyde concentrations in air from wood products under test conditions of temperature and relative humidity in accordance with ASTM D 6007 or ASTM E 1333.
2. Determine Volatile Organic Compounds (VOC), excluding formaldehyde, emitted from manufactured wood-based panels in accordance with ASTM D 6330.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood panels.

2.4 DIMENSION LUMBER

A. Grading Agency: Southern Pine Inspection Bureau (SPIB).

B. Sizes: Nominal sizes, S4S/rough (unsurfaced).

C. Moisture Content: Kiln-dry or MC15.

D. Miscellaneous Blocking and Nailers:

1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.2 ROOFTOP CURB INSTALLATION

A. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

B. Coordinate curb installation with installation of decking and support of deck openings.

3.3 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.4 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.5 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (0.7 mm/m) maximum.

END OF SECTION 061000

SECTION 061500 - WOOD DECKING

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.

B. Framing System.

1.2 SUMMARY

A. This Section includes the following:

1. Wood deck panels.

1.3 REFERENCED STANDARDS

A. ASTM - American Society for Testing and Materials International.

1. ASTM E 84: Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Product Data: Submit product data, including guide specifications, for specified products.

B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including accessories.

C. Samples: Submit 12"x12" size samples for selection and verification of materials.

D. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

E. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
2. Manufacturer's Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

B. Meets Class A requirements for flame spread and smoke developed per ASTM E 84 testing.

C. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, substrate conditions, manufacturer's instructions and manufacturer's warranty requirements. Comply with Section 013100 "Project Management and Coordination."

1.6 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful conditions.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide the following:

1. Prodema; ProdEX composite wood panels (Basis-of-Design) or equal as approved by Architect.

a. Refer to Event Entrance Details: A-330's.
b. Refer to Visitor Staff Entry Details: A-340's.
c. Refer to Gallery Entry Details: A-350's.
d. Refer to Courtyard Details: A-360's.

2.2 MATERIALS

A. Wood Deck Panels: Composite bakelite core panels faced with natural wood veneer with manufacturer's synthetic resins and PVDF coating.

1. Face Veneer Grade and Cut: Grade A rotary cut hardwood veneer.
2. Core: Bakelite.
3. Panel Dimensions: As indicated on Drawings.
4. Overall Thickness: 11/16 inch (18 mm).
5. Finish Texture: Smooth.

a. Face Veneer Species and Color: "Ayous Veneer" 'Dark Brown' or equal as approved by Architect.

B. Mounting: Manufacturer's recommended concealed fixing panels with hanging profiles as approved by Architect.

C. Sub Structure: Manufacturer's recommended aluminum back-up channel system or equal as approved by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.2 INSTALLATION

A. Comply with Manufacturer's Technical Manual for procedures and techniques for wood decking installation.

3.3 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.4 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 061500

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Glass-mat gypsum sheathing.
2. Building wrap.
3. Sheathing joint-and-penetration treatment.
4. Flexible flashing at openings in sheathing.

1.3 REFERENCED STANDARDS

A. ASTM - American Society for Testing and Materials International.

1. ASTM B 117: Practice for Operating Salt Spray (Fog) Apparatus.
2. ASTM C 9544: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
3. ASTM C 1177: Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
4. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM E 96: Test Methods for Water Vapor Transmission of Materials.
6. ASTM E 119: Test Methods for Fire Tests of Building Construction and Materials
7. ASTM F 1667: Specification for Driven Fasteners: Nails, Spikes, and Staples.

B. GA - Gypsum Association.

1. GA -253: Application of Gypsum Sheathing.

C. ICC - International Code Council Evaluation Service, Inc.

1. NES NER-272: Pneumatic or Mechanically Driven Staples, Nails, P-Nails and Allied Fasteners for Use in All Types of Building Construction.

D. UL - Underwriters Laboratories Inc.

1. Fire Resistance Directory, Published annually.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

B. Research/Evaluation Reports: For building wrap, showing compliance with building code in effect for Project.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. G-P Gypsum Corporation; Dens-Glass Gold.
b. National Gypsum Company; Gold Bond e(2)XP.
c. CertainTeed Corporation; GlasRoc.

2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.

2.3 WEATHER-RESISTANT SHEATHING PAPER

A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fortifiber Building Systems Group (Basis-of-Design).
b. DuPont (E. I. du Pont de Nemours and Company).
c. Dow Chemical Company (The).
d. Pactiv, Inc.
e. Raven Industries Inc.
f. Reemay, Inc.

2. Basis-of-Design Product: Fortifiber Building Systems Group; Super Jumbo Tex 60 Minute or approved equal.

a. Composition: Asphalt-saturated kraft Grade "D" breather type sheathing paper.

3. Water Vapor Transmission: 75 grams/11 perms (MVT) per test method ASTM E-96(A).
4. Water Resistance: > 60 minutes per test method ASTM D-779.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

2.5 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch (0.8 mm).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Coatings & Waterproofing.
b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.
c. MFM Building Products Corp.
d. Polyguard Products, Inc.
e. Protecto Wrap Company.

B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

D. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.

3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

3.3 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.

B. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.5 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Prime substrates as recommended by flashing manufacturer.

2. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
4. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 061600