



Silicon Valley Berryessa Extension Project

**C700 - Line, Track, Stations, and
Systems
Design - Build**

**Volume 6 – BART Facilities
Standards R2.1
October 2009**

**Approved for SVRT Use – Effective June 1, 2010
Book 3 of 5**

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Silicon Valley Rapid Transit Project

BART Facilities Standards R2.1

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Volume 3 of 5
Standard Specifications

P0501-P100-STD-DI-001
B0410-A003





SILICON VALLEY RAPID TRANSIT PROJECT

**BART FACILITIES STANDARDS, RELEASE 2.1
VOLUME 3 OF 5
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BART Facilities Standards (BFS)

Release 2.1

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**Prepared By:
BART**

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5.1 Division 1

General Requirements

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SECTION 01 11 00

SUMMARY OF WORK

1.01 DOCUMENTS:

A. The Work shall be performed and completed in accordance with the following documents:

1. The General Conditions for Construction Contracts and the Supplementary Conditions; the Contract Specifications which invoke, modify, and augment the Standard Specifications; and the various forms and exhibits; all contained in the Contract Book.
2. The Standard Specifications for Construction Contracts, bound separately.
3. The Contract Drawings and, if applicable, Reference Drawings, contained in the Contract Book or bound separately.

1.02 **CONTRACT DESCRIPTION, COMPLETION TIME AND LIQUIDATED DAMAGES:** Contract Specifications, Section 01 11 00, Summary of Work, will contain a description of the Work under the Contract, time of completion, and the amount of liquidated damages.

1.03 HOURS OF WORK

- A. Work shall be performed between the hours of 7:00 a.m. and 7:00 p.m., on weekdays.
- B. Work shall not be performed on Saturdays, Sundays or legal holidays.
- C. Exceptions to the above hours of work will be permitted only after obtaining written authorization from the Engineer.

END OF SECTION 01 11 00

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

1.01 DESCRIPTION

- A. This Section includes specifications for measurement and payment as they apply to the Work, and includes provisions applicable to lump sum prices, unit prices, and allowances, as indicated.
- B. Measurement methods specified in the individual Sections of these Specifications shall govern if they differ from methods specified in this Section.

1.02 LUMP-SUM MEASUREMENT

- A. Lump-sum measurement will be for the entire item, unit of work, structure, or combination thereof, as specified and as indicated in the Bid Schedule of the Bid Form.
 - 1. If the Contractor requests progress payments for lump-sum items or amounts in the Bid Schedule, such progress payments will be made in accordance with a well-balanced, detailed program of payment-apportioning, prepared by the Contractor and submitted to the Engineer for approval. Such payment-apportioning may require modifications during the Contract, as determined by the Engineer.
 - 2. Such program for each applicable lump-sum item shall show fixed definable and measurable quantities where possible and unit prices therefor as developed and assigned by the Contractor to the different features of the work and major subdivisions thereof. The summation of extensions of quantities and unit prices and related costs shall equal the amount of the lump-sum Contract Price or lump sum bid item indicated in the Bid Schedule.
 - 3. Following the Engineer's approval, progress payments will be made in accordance with the Contractor's payment-apportioning program and from the approved progress schedule, reflecting the progress which occurred during the payment period as approved by the Engineer.

1.03 MEASUREMENT OF QUANTITIES FOR UNIT PRICES

- A. Measurement Standards:
 - 1. All work to be paid for at a Contract price per unit measurement, as indicated in the Bid Schedule, will be measured by the Engineer in accordance with United States Standard Measures.
 - 2. A ton shall consist of 2,000 pounds avoirdupois.
- B. Measurement by Weight:
 - 1. Reinforcing steel, steel shapes, castings, miscellaneous metal, metal fabrications, and similar items to be paid for by weight shall be measured by scale or by handbook weights for the type and quantity of material actually furnished and used.

PRICE AND PAYMENT PROCEDURES

2. Unless shipped by rail, material to be measured and paid for by weight shall be weighed on sealed scales regularly inspected by the State Division of Measurement Standards or its designated representative, furnished by and at the expense of the Contractor. All weighing, measuring, and metering devices shall be suitable for the purpose intended and shall conform to the tolerances and specifications as outlined in the California Code of Regulations, Title 4, Chapter 9, Division 5.
3. Provide or utilize platform scales of sufficient size and capacity to permit the entire vehicle or combination of vehicles to rest on the scale platform while being weighed. Combination vehicles may be weighed as separate units provided they are disconnected while being weighed. Scales shall be inspected and certified as often as the Engineer may deem necessary to ascertain accuracy. Costs incurred as a result of regulating, adjusting, testing, inspecting, and certifying scales shall be borne by the Contractor.
4. A licensed weighmaster shall weigh all materials weighed on scales furnished by the Contractor. The Engineer may be present to witness the weighing and to check and compile the daily record of such scale weights. However, in any case, the Engineer will require that the Contractor furnish weight slips and daily summary weigh sheets. In such cases, furnish a duplicate weight slip or a load slip for each vehicle weighed and deliver the slip to the Engineer at the point of delivery of the material.
5. If the material is shipped by rail, the certified car weights will be accepted, provided that only actual weight of material will be paid for and not minimum car weights used for assessing freight tariff. Car weights will not be acceptable for material to be passed through mixing plants. Material to be measured by weight shall be weighed separately for each bid item under which it is to be paid.
6. Trucks used to haul material being paid for by weight shall be weighed empty daily and at such additional times as the Engineer may require. Each truck shall bear a plainly legible identification mark. The Engineer may require the weight of the material verified by weighing empty and loaded trucks on such other scales as the Engineer may designate.

C. Measurement by Volume:

1. Measurement by volume will be by the cubic dimension indicated in the Bid Schedule. Method of volume measurement will be by the unit volume in place or removed as shown on the Contract Drawings or as specified.
2. When material is to be measured and paid for on a volume basis and it is impractical to determine the volume by the specified method of measurement, or when requested by the Contractor in writing and accepted by the Engineer in writing, the material may be weighed in accordance with the requirements specified for weight measurement. Such weights will be converted to volume measurement for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities will be accepted.

D. Measurement by Area: Measurement by area will be by the square dimension shown on the Contract Drawings or as specified. Method of square measurement will be as specified.

- E. Linear Measurement: Linear measurement will be by the linear dimension listed or indicated in the Bid Schedule. Unless otherwise indicated, items, components, or work to be measured on a linear basis will be measured at the centerline of the item in place.
- F. Field Measurement for Payment:
 - 1. The Engineer will compute all quantities of work performed by the Contractor on a unit-price basis, for payment purposes.
 - 2. The Contractor shall assist the Engineer in the taking of measurements by providing all equipment, workers, and survey crews as required to measure quantities in accordance with the provisions for measurement specified herein and in Section 01 71 23, Field Engineering. Unless otherwise specified, all quantities shall be calculated using dimensions shown on the Contract Drawings. No allowance will be made for specified tolerances.

1.04 VALUES OF UNIT PRICES

- A. The number of units and quantities contained in the Bid Schedule as estimated quantities are approximate only, and final payment will be made for the actual number of units and quantities which are incorporated in the Work and required by the Contract, as measured by the Engineer.
- B. In the event that work or materials or equipment are required to be furnished to a greater or lesser extent than is indicated in the Contract Documents, such work or materials or equipment shall be furnished in greater or lesser quantities in accordance with General Conditions Article GC4.5, Increased or Decreased Quantities.

1.05 ALLOWANCES

- A. Description: Allowances specified in the Contract Documents and indicated in the Bid Schedule shall cause the work so covered to be furnished, performed, and completed for such sums as are acceptable to the Engineer and shall include the cost to the Contractor of all materials and equipment to be delivered and installed under the specified allowances.
- B. Specific Allowances: Specific allowances, if any, included in the Contract are specified in Contract Specifications Section 01 20 00, Price and Payment Procedures, and are indicated in the Bid Schedule.
- C. Administration:
 - 1. The allowances specified in the Contract Specifications and indicated in the Bid Schedule are exclusive of any work indicated in the Contract Documents for which payment is included under other specifically designated items in the Bid Schedule.
 - 2. Unless compensation for allowance work is agreed upon, a Force Account Daily Report form shall be used to track and record actual expenditures and expenses related to each allowance. Authorization for payments to the Contractor will be based on such Daily Reports and a related progress schedule.

3. Upon Acceptance of the Work, a Change Order will be prepared, reflecting the exact amount due to the Contractor if different from the exact amounts of the specified allowances.

1.06 CONTRACT PAYMENTS

A. Progress Payments:

1. Invoice for Work Completed: Not more than once each month the Contractor shall submit to the Engineer an invoice for work performed or completed on forms supplied by the Engineer. The invoice shall be certified, and shall be supported by evidence as required by the Engineer, that the work invoiced has been completed, and that the materials listed are at the storage places indicated.
2. Invoice for Stored Materials: Unless otherwise specified in the Contract Specifications, partial payments for Contractor-furnished materials not yet installed will be made only after such materials have been furnished and stored for use in the Work, provided they are stored in an area approved by the Engineer. All such material shall be covered by insurance. Said invoice may include the amount and value of such acceptable material as has been furnished and delivered to the site, and such acceptable material as has been furnished and stored for use in the Work, provided it is stored within the San Francisco Bay Area and is segregated and designated for exclusive use of the District.
3. Cost Determination: The cost of invoiced materials shall be determined in accordance with General Conditions Article GC9.3.1.2, Materials. Invoices from suppliers shall be furnished to substantiate the cost.

B. Full Compensation:

1. Payment will be full compensation for furnishing all labor, materials, tools, equipment, transportation, facilities, services, and incidentals, as specified in General Conditions Article GC9.1, Scope of Payment, and for performing all work necessary for completing the construction or installation of the item or work classification.
2. Whenever it is specified or indicated in the Contract Documents that the Contractor is to perform work or furnish materials for which no price is fixed in the Contract, it is understood and agreed that there is included in each lump-sum price bid, or unit price bid, the entire cost of the Work, including all items of work which are incidental to the completion of those portions of the work covered by such lump-sum price bid, or unit price bid, or, if not directly incidental to any specific Bid Item in the Bid Schedule, the cost thereof has been distributed among those Bid Items in the Bid Schedule considered most appropriate by the Contractor.
3. Work which is not clearly delineated in the Contract Documents to be under a particular Bid Item in the Bid Schedule shall be automatically assigned to one of the lump-sum Construction items in the Bid Schedule by the Contractor, so that all items of work, regardless of their characteristics or anonymity, are included in the Contract Price. Additional compensation will not be made for work items which do not clearly fall under

listed Bid Items in the Bid Schedule.

1.07 REJECTED, EXCESS, OR WASTED MATERIALS: Quantities of material wasted or disposed of in a manner not called for under the Contract; rejected loads of material, including material rejected after it has been placed by reasons of the failure of the Contractor to conform to the provisions of the Contract; material not unloaded from the transporting vehicle; material placed outside the lines indicated on the Contract Drawings or established by the Engineer; or material remaining on hand after completion of the Work, will not be paid for, and such quantities shall not be included in the final total quantities. No additional compensation will be permitted for loading, hauling, and disposing of rejected material.

1.08 MEASUREMENT AND PAYMENT: Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

END OF SECTION 01 20 00

SECTION 01 31 19

PROJECT MEETINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Pre-construction meeting.
- B. Construction Progress meetings.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection therewith will be considered incidental to the item of work to which they pertain.

1.03 PRE-CONSTRUCTION MEETING:

- A. A pre-construction meeting will be scheduled by the Engineer not more than seven working days after the effective date of the Notice to Proceed. The purpose of this meeting is to introduce the Engineer's representatives for construction management to their counterparts in the Contractor's organization and to establish lines of communication among these representatives. The Contractor's Project Manager, superintendent, quality representative, safety representative, EEO officer, Subcontractor representatives, and community relations representatives shall attend. Not less than four working days before the meeting, the Engineer will distribute a notice of this meeting, along with an agenda of the subjects to be addressed.
- B. The Engineer will discuss the following requirements at this meeting:
 - 1. Responsibilities and authorities of the District and the Engineer.
 - 2. Equal Employment Opportunity (EEO) and Community Relations functions.
 - 3. Quality control, inspection, and coordination of the Work.
 - 4. Discuss and establish arrangements for safety, first-aid, emergency actions, security, and full-time safety representative.
 - 5. Traffic requirements and permit requirements as applicable to the Work.
 - 6. Procedures for submitting and processing Change Notices, Change Orders, Shop Drawings, product data, and samples.
 - 7. Monthly progress payment cut-off dates.
 - 8. Partial and final payments.
- C. The Contractor shall perform the following at this meeting:

PROJECT MEETINGS

1. Introduce the Contractor's representatives, and briefly describe each person's responsibilities.
2. Distribute and discuss the list of major Subcontractors, their areas of responsibility, sequence of critical work, and tentative schedule of construction.
3. Discuss use of office, storage areas, staging areas, construction areas, and temporary easements.
4. Discuss construction safety.
5. Define housekeeping procedures.
6. Discuss construction methods.
7. Discuss quality control/quality assurance.
8. Describe construction sequencing of the entire Contract, general jobsite layout, erosion and sedimentation control plans, haul routes, noise abatement, dust abatement, air and water pollution control, temporary street closings, and street restoration, as applicable.
9. Discuss coordination and notifications required for utility work and services.
10. Discuss deliveries and priorities of major equipment.
11. Discuss breakdown of lump sum items.
12. Discuss construction progress schedule.

1.04 CONSTRUCTION PROGRESS MEETINGS

- A. The Engineer will schedule construction progress meetings each week and more often as necessary for the competent and timely execution of the Contract. The Contractor's personnel indicated in Article 1.03 shall attend these meetings. Progress meetings shall include representatives of Subcontractors who are or will be performing work during the next week.
- B. The Engineer will distribute notices of these meetings before such meeting to the Contractor.
- C. The agenda for construction progress meetings will be prepared by the Engineer with input from the Contractor and will include the following:
 1. Introduction of new attendees and areas of responsibility.
 2. Review of minutes of previous meetings, amendment of minutes if necessary, and acceptance of minutes.
 3. Analysis of work accomplished since the previous meeting, offsite fabrication problems, product delivery problems, submitted schedule slippages, problems arising from proposed changes, and other circumstances which might affect progress of the Work. The

PROJECT MEETINGS

Contractor shall have an updated schedule showing all activities started, completed, and on going during previous week and such activities scheduled for the next week.

4. Discussion of sequence of work on the critical path, and schedule of construction using the progress schedule. Each activity shall have a current status and forecast completion. The Contractor shall report on all activities which are forecast to be completed beyond the approved schedule date(s) and shall identify means of maintaining the approved schedule.
5. Discussion of work quality observations, problems, and employee work standards.
6. Discussion of coordination of utility work and other work by outside parties.
7. Discussion of changed conditions, time extensions, and other relevant subjects as they affect the progress of the Work.
8. Discussion of corrective measures to maintain construction progress schedule when necessary.
9. Discussion of potential claims and pending disputed issues.
10. Inquiries, requests for information, and Change Notices/Change Orders.
11. Discussion of upcoming month's work.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 31 19

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Scheduling format.
- B. Submittals
- C. Four-week plan
- D. Monthly progress status report.
- E. Review, updates, and revisions.
- F. Requests for time extensions.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 GENERAL

- A. Progress schedules shall represent a practical plan to complete the Work within the Contract time(s) of completion indicated, and shall convey the Contractor's intent in the manner of prosecution and progress of the Work.
- B. The scheduling and execution of construction in accordance with the Contract Documents are the responsibility of the Contractor. The Contractor shall involve and coordinate all Subcontractors and material Suppliers in the development and updating of progress schedules.
- C. The submittal of progress schedules shall be understood to be the Contractor's representation that the progress schedule meets the requirements of the Contract Documents and that the Work will be executed in the sequence and duration indicated in the progress schedule.

1.04 SCHEDULING FORMAT

- A. The Contract Schedule shall be computer produced in the Critical Path Method (CPM) format. The schedule shall be computer produced utilizing project scheduling software such as Primavera, Microsoft Project, SureTrak, Timeline or other equivalent software as approved by the Engineer.
- B. The Contract Schedule shall be updated monthly and submitted as indicated in Article 1.05, Submittals.

- C. The schedule shall show Contract tasks, percent complete, progress bars, baseline schedules, milestones, start and finish dates, and other breakdowns as required by the Engineer. The schedules shall show clearly the sequence of activities and shall list specifically the following activities:
1. Interim milestone completion dates. Phasing and staging of the Work as specified shall be prominently identified.
 2. Submittals and the Engineer's review of submittals.
 3. District inspection of the Work, including Preliminary Final Inspection, Final Inspection, punch list(s), and Acceptance.
 4. Acquisition of permits.
 5. Any long lead time (over 60 days) orders for material and equipment.
 6. Work to be performed by other contractors or agencies.
 7. Delivery of District-furnished materials (DFM) and District-furnished equipment (DFE) indicated for incorporation in the Work.
- D. Descriptions of scheduled activities shall include sufficient detail to identify the work that is to be accomplished.
1. The schedule shall contain sufficient activities to clearly show the sequence and interdependencies of the Work. The schedule shall be prepared in such a way that an activity or group of activities will correspond directly with the bid item breakdown and/or the breakdown of lump sum bid items. The Engineer may request that additional activities be added.
 2. Activity durations shall be expressed in whole days. Work that is to be performed by Subcontract shall be clearly defined.
 3. Float suppression techniques, such as preferential sequencing (crew movement, equipment use, and form reuse), extended duration, imposed dates, scheduling of work not required for the Contract, and others, shall not be used to affect or limit float in the schedule. The use of constraint dates should be minimized, and must be approved by the Engineer.
 4. Critical Path operations are those activities with a total float equal to or less than zero. Schedules with negative total float may be found to be impractical by the Engineer.
- E. A schedule showing that Work that is completed in less than the completion time specified may be found to be impractical by the Engineer.
- F. A schedule showing that Work that is completed in less than the completion time specified, that is found to be practical by the Engineer, shall be considered to have float. The float shall be the time between the scheduled completion of the Work and the Contract

completion date. Float time shall not be for the exclusive benefit of either the District or the Contractor. Float shall be a resource available to both parties.

- G. A schedule found to be impractical for the preceding reasons or any other reasons shall be revised by the Contractor and resubmitted.

1.05 SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.
- B. Schedules shall be submitted in time-scaled bar-chart (Gantt) format with logic lines shown on sheets no smaller than 22 inches wide by 34 inches long, nor larger than 34 inches wide by 44 inches long. A time-scaled logic network diagram may also be required by the Engineer. An activity report in a tabular form showing the following information shall be submitted with bar-chart: activity ID, description, duration, total float, early start, early finish, late start, late finish, predecessors, successors, constrains, percent complete, and remaining duration.
- C. All schedule submittals shall include one reproducible and six full-size copies.
- D. Schedule submittals will be reviewed by the Engineer, and shall be updated and revised as indicated in Article 1.08, Review, Updates, and Revisions. Resubmittals shall conform to the same requirements as original submittals.
- E. The Contractor shall prepare and submit all schedules and schedule analysis reports in electronic format on MS Windows-compatible CD-ROM as well as hard copies.
- F. All progress schedule submittals are subject to review and approval by the Engineer. The Engineer retains the right to withhold progress payments until the Contractor submits a progress schedule and progress schedule updates acceptable to the District.
- G. The Contractor shall submit the schedule within 30 days after the date of the Notice to Proceed.
- H. The first of each type of schedule and the first Monthly Progress Status Report submitted by the Contractor will be reviewed for format, as well as content. The Engineer may request format changes. Once the format has been approved, all subsequent Schedules and Progress Status Reports shall be submitted in the approved format.

1.06 FOUR-WEEK WORK PLAN

- A. A schedule in calendar time-scaled bar chart format depicting the Contractor's intended work activities for the upcoming four-week period shall be submitted on a weekly basis and shall be due on the first working day of each week. Each activity of one day or more in duration shall be indicated.

- B. Any deviations, such as sequences of work, timing, and durations of activities from the approved Project Schedule, shall be noted and explained in writing.
- C. The Four-Week Work Plan shall be submitted on sheets not less than 8-1/2 inches by 11 inches, or as approved by the Engineer.

1.07 MONTHLY PROGRESS STATUS REPORT

- A. The Monthly Progress Status Report shall be a narrative report that describes work activities accomplished in the reporting period, intended work activities for the upcoming reporting period, problems and actions intended by the Contractor to mitigate the problems, work that is being performed out of sequence with approved schedules, status of Change Orders, Notices of Potential Claims, status of submittals, and status of Contractor procurement items.
- B. The Contractor shall submit the report format and obtain the Engineer's approval of the format.
- C. The Monthly Progress Status Report shall be submitted monthly on sheets no larger than 11 inches by 17 inches, nor any smaller than 8-1/2 inches by 11 inches.

1.08 REVIEW, UPDATES, AND REVISIONS

- A. The Engineer will review and return the Contractor's schedule submittals with written comments according to the following schedule from the date of receipt.

Contract Schedule: 10 calendar days

Four-Week Work Plan: 5 calendar days

- B. The Contractor shall make all corrections to the Project Schedule requested by the Engineer and resubmit the schedule for approval. If the Contractor does not agree with the Engineer's comments, the Contractor shall provide written notice of disagreement within five days from the receipt of the Engineer's comments. The Engineer's comments on the Four-Week Work Plan for which the Contractor disagrees shall be resolved in a meeting held for that purpose, if necessary.
- C. At least once each month, or as often as deemed necessary by the Engineer, the Contractor shall submit an updated schedule showing the progress of the Work to date and anticipated activities to be worked on, and the Monthly Progress Status Report as specified in Article 1.07. The submittal of the Project Schedule update and Monthly Progress Status Report shall be at least five days prior to the submittal of a payment invoice. No invoice will be accepted nor payment made if there is not an approved current update in place.
- D. If, according to the approved Project Schedule, the Contractor is thirty or more days behind the Contract completion date of any milestone indicated, or the schedule contains 30 or more days of negative float, considering all approved time extensions, the Contractor shall submit a revised schedule, showing a practical plan to complete the Work within the specified Contract completion time. The District may withhold progress payments until a revised schedule, acceptable to the Engineer, is submitted by the Contractor.

1.09 REQUESTS FOR TIME EXTENSIONS

- A. If the Contractor requests an extension of time for the completion of an interim milestone date or Contract completion date of the Work, the Contractor shall furnish necessary justification for such extension so that the Engineer can determine whether or not the Contractor is entitled to an extension of time under the provisions of the Contract. Submission of proof based on revised activity logic, duration, and costs is obligatory to any approvals. The cost of such justification or subsequent schedule revisions shall be borne solely by the Contractor.
1. The schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved in its request.
 2. The Engineer's determination as to the total number of days of Contract extension will be based upon the current schedule for the time period in question, and all other relevant information. Actual delays in activities that, according to the schedule, do not affect the extended and predicted Contract completion dates as shown by the Critical Path, will not be the basis for a change to the Contract completion date.
 3. After receipt of such justification and supporting evidence, the Engineer will review the facts and advise the Contractor in writing of the Engineer's decision. If the Engineer determines that the Contractor is entitled to an extension of time to an interim milestone, the Contract completion date will remain the same, unless the Engineer specifies another date. Any change to Contract milestones or to the Contract completion date will be made by Change Order.
- B. As part of each request for extension, a fragnet showing all schedule logic revisions, duration changes, and cost changes for the work in question and its relationship to other activities on the Project Schedule shall be submitted.
1. If the Engineer has not yet made a full determination as to the amount of time extension to be granted and the parties are unable to agree as to the amount of extension to be reflected in the schedule, the Contractor shall reflect that amount of time extension in the schedule as may determined to be appropriate by the Engineer for such interim purpose. It is understood and agreed that such interim determination by the Engineer for the purposes of this Article 1.09.B.1 will not be binding upon either party for any other purpose, and that, after the Engineer has made a final determination as to any time extension, the Contractor shall revise the schedule in accordance with the final decision.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 32 16

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Stages of construction.
- B. Quality and quantity of photographs.
- C. Identification of photographs.
- D. Video recordings.
- E. Disputes, and potential claims.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 STAGES OF CONSTRUCTION

- A. The Contractor shall take photographs at all construction milestones and at each of the following stages of construction:
 - 1. Before commencement of clearing and demolition;
 - 2. Upon completion of clearing and demolition;
 - 3. Monthly during performance of the Work; and
 - 4. Upon completion of the Work.
 - 5. Anytime a problem arises that may result in a Notice of Potential Claim and the problem can be illustrated by photographs.
- B. Furnish at least three different views or vantage points of each milestone and stage of construction. Furnish an average of 20 photographs each month until completion of the Work. Location of views shall be as approved by the Engineer.

1.04 QUALITY AND QUANTITY OF PHOTOGRAPHS

- A. All photographs shall be standard commercial quality, color prints, on single weight glossy paper.
- B. Photographs shall be 5 by 7 inches in size.
- C. Furnish the negative and three prints of each photograph.

- D. Digital photographs stored on CD-ROM or DVD may be substituted for standard photographs addressed above. Digital photographs shall be in pdf, jpg, or tif format.

1.05 IDENTIFICATION OF PHOTOGRAPHS

- A. The following information shall be typed on the back of each print furnished and furnished for each digital photograph in a manner approved by the Engineer.

- 1. Title of Contract and Contract Number;
- 2. Identification of subject shown;
- 3. Station point of camera and direction of view;
- 4. Time and date taken.

1.06 VIDEO RECORDINGS

- A. The Contractor shall provide video recordings of all construction milestones and the following events:

- 1. Start of construction including clearing and demolition operations, as applicable;
- 2. Highlights of all formal inspections; and
- 3. Highlights of the final inspection and acceptance by the District.

- B. Video recordings shall be standard video cassettes (6-inch nominal length) of the video home system (VHS) type and highest grade, capable of being shown on a television screen with video cassette recorder (VCR) attachment.

- C. Video recordings shall include a complete, clearly spoken narration of the events being photographed. Also, video recordings shall include an unobtrusive time and date indicator on the film, accurately depicting the time and date when the photography was performed.

- D. The video cassette shall be labeled with the same identifying information specified above for photographs. In addition, the narration of each recording shall lead off with this same identifying information.

1.07 DISPUTES AND POTENTIAL CLAIMS:

- A. In the event a problem arises or dispute occurs which may result in a Notice of Potential Claim under Article GC9.4.1 of the General Conditions and the problem or dispute can be illustrated by photographs and video recordings, the Contractor shall provide such photographs and video cassettes.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 32 33

BART Facilities Standards (BFS)

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. List of material sources.
- B. Submittal requirements.

1.02 RELATED SECTIONS

- A. Project progress schedules and status reports are specified in Section 01 32 16 - Construction Progress Schedules.
- B. General requirements and procedures for preparing and submitting Shop Drawings, product data, and samples are specified in Section 01 33 23 - Shop Drawings, Product Data, and Samples.
- C. Submittals related to the Contractor's quality program are specified in Section 01 45 00 - Quality Control.
- D. Submittals required to complete the Contract closeout are specified in Section 01 77 00 - Closeout Procedures.
- E. Preparation and submission of project record documents are specified in Section 01 78 39 - Project Record Documents.
- F. Preparation and submission of equipment and systems operation and maintenance manuals are specified in Section 01 78 23 - Operation and Maintenance Data.
- G. Preparation and submission of Training Program Deliverables such as Training Program Plan, Instructor Guides, and Student Training Manuals are specified in Section 01 79 00 - Demonstration and Training.

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 LIST OF MATERIALS SOURCES: The Contractor shall submit to the Engineer a list of the Contractor's sources of materials. The list shall be submitted in sufficient time to permit proper inspections and testing of materials to be furnished from such listed sources in advance of their use.

1.05 SUBMITTAL REQUIREMENTS

A. Schedule of Submittals: Within ten calendar days after the effective date of Notice to Proceed, the Contractor shall submit a completed submittal schedule and list of products for all items requiring the Engineer's review and approval, as follows:

1. Submittals, including description of the item and name of manufacturer, trade name and model number.
2. Specification reference.
3. Intended submission/resubmission date(s).
4. Order release date.
5. Lead time to delivery/anticipated delivery date(s).
6. Highlight any items that require expedited review to meet the project schedule.

These schedules shall be presented in a form acceptable to the Engineer in both electronic and hard copy versions and shall be updated and sent to the Engineer on a monthly basis. Identify all submittals that are required by the Contract Documents and determine the date on which each submittal will be submitted in conformance with the schedules specified in Section 01 32 16 - Construction Progress Schedules.

B. Professional Seal Required: Submittals involving engineering design services, when required by the Contract Documents or by governing codes and regulations, such as shoring and underpinning, excavation support structures, falsework for concrete, fire protection system design, and load and design calculations, shall be sealed and signed in blue ink by a professional engineer, currently registered in the State of California, for the discipline involved.

C. Review Period:

1. Prepare submittals sufficiently in advance so that approval may be given before commencement of related work.
2. Allow 30 calendar days after receipt by the Engineer for review of each submittal, including resubmittals.
3. The Contractor shall be responsible for determining whether or not certain governmental entities and utility districts require longer review periods. When longer review periods are required, the Contractor shall schedule the Work accordingly, so that the Work and project progress schedules are not adversely impacted.

D. Submittal Delivery: Ship submittals prepaid or deliver by hand directly to the Engineer.

E. Transmittal Form: Accompany submittals with a District-furnished transmittal form in duplicate containing the following information:

SUBMITTAL PROCEDURES

1. The Contractor's name, address, and telephone number;
 2. Submittal number and date;
 3. Contract title and number;
 4. Supplier's, manufacturer's, or Subcontractor's name, address, and telephone number; and
 5. Subject identification including Contract Drawing and Specification reference.
- F. Changes in Approved Submittals: Changes in approved submittals will not be allowed unless those approved submittals with changes have been resubmitted and approved, in the same manner as the original submittal.
- G. Supplemental Submittals: Supplemental submittals initiated by the Contractor for consideration of corrective procedures shall contain sufficient data for review. Make supplemental submittals in the same manner as initial submittals.

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Contractor's Review and Approval:
1. Each submittal shall be reviewed, stamped, and signed as reviewed and approved by the Contractor prior to submission. The Contractor's approval shall indicate review and approval with respect to the following responsibilities:
 2. The Contractor shall be responsible for:
 - a. The correctness of the drawings, for shop fits and field connections, and for the results obtained by the use of such drawings.
 - b. Verification of catalog numbers, and similar data.
 - c. Determination and verification of field measurements and field construction criteria.
 - d. Checking and coordinating information in the submittal with requirements of the Work and of the Contract Documents.
 - e. Determination of accuracy and completeness of dimensions and quantities.
 - f. Confirmation and coordination of dimensions and field conditions at the site.
 - g. Safety precautions.
 - h. Errors or omissions on submittals.
 - i. Coordination and performance of work of all trades.
 - j. Identification of deviation(s) from Contract requirements.
 3. The Contractor shall coordinate each submittal with the requirements of the Work, placing particular emphasis upon assuring that each submittal of one trade is compatible

with other submittals of related work. Ensure submittal is complete with all relevant data required for review.

4. The Contractor shall stamp, initial or sign the submittal, certifying:
 - a. Dimensional compatibility of the product with the space in which it is intended to be used.
 - b. Review of submittals for compliance with Contract requirements.
5. Do not start work for that requires approval by the Engineer until submittals have been returned to the Contractor with official indication that approval has been granted by the Engineer.
6. If the submittal is designated to be sent to the Engineer for information, approval by the designated approval authority shall take place before submission to the Engineer.
7. Approval of drawings and associated calculations by the Engineer shall not relieve the Contractor from the responsibility for errors or omissions in the drawings and associated calculations, or from deviations from the Contract Documents, unless submittals containing such deviations were submitted to the Engineer and the deviations were specifically called to the attention of the Engineer in the letter of transmittal and within the submittal, and approved specifically by the Engineer as a Contract change.
8. Approval of the Contractor's submittal by the Engineer shall not relieve the Contractor of any responsibility, including responsibility for accuracy and agreement of dimensions and details.

B. Submittal Quantities: Refer to Contract Specifications Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal quantities.

C. Review by the Engineer: One marked up reproducible set of drawings, one copy of product data, and one sample will be returned to the Contractor.

D. Distribution of Submittals after Review: Distribute prints or copies of approved submittals, bearing the Engineer's or designated approval authority's stamp and signature, to the Contractor's field office and the Engineer's field office; to affected and concerned Subcontractors, Suppliers, and fabricators; and to affected and concerned members of the Contractor's workforce.

1.07 ENGINEER'S REVIEW

A. Submittals will be reviewed for conformance with requirements of the Contract Documents. Review of a separate item will not constitute review of an assembly in which the item functions. Nether review nor approval shall relieve the Contractor from Contractor's responsibility for accuracy of submittals, for conformity of submittals to requirements of Contract Documents, for compatibility of described product with other provided products and the rest of the system, or for prosecution and completion of the Contract in accordance with the Contract Documents.

B. Submittals shall be understood as being made for approval, unless otherwise specified, for example, as being made for information, record, or review. The Engineer will indicate its

SUBMITTAL PROCEDURES

reviews of submittals and the action taken (approvals and nonapprovals) by means of its review stamp. The review stamp will be affixed by the Engineer, the action block will be marked, and the stamp will be signed in blue ink and dated.

1. Approval of the submittal by the Engineer does not relieve the responsibilities of the professional engineer who originally signed and sealed the submittal or the responsibilities of the Contractor to meet the Contract requirements..

C. The review-stamp action-block marks will have the following meanings:

1. The mark APPROVED is an acceptance, and means that the submittal appears to conform to the respective requirements of the Contract Documents; that fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed; and that the submittal need not be resubmitted.
2. The mark APPROVED AS NOTED - RESUBMISSION NOT REQUIRED is an acceptance, and means that the submittal appears to conform to the respective requirements of the Contract Documents upon incorporation of the reviewer's corrections, and that fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed. Submittals so marked need not be resubmitted unless the Contractor challenges the reviewer's exception within 7 calendar days. All noted changes will be reflected in the as-built drawing by the Contractor.
3. The mark LIMITED APPROVAL – RESUBMISSION REQUIRED is an approval except for the work impacted by the notes and comments, and means that the submittals requires corrections to conform to the respective requirements of the Contract Documents. Fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may proceed at the Contract's risk only for the elements of work not impacted by and changes required to incorporate the reviewer's corrections. The noted work cannot proceed until verification by the Engineer that the review's correction have been properly incorporated in the submittal.
4. The mark NOT APPROVED - RESUBMISSION REQUIRED is a disapproval, and means that the submittal requires corrections to conform to the respective requirements of the Contract Documents, and that fabrication, assembly, manufacture, installation, application, and erection of the illustrated and described product may not proceed until incorporation of the reviewer's corrections and verification by the Engineer that the reviewer's corrections have been properly incorporated in the submittal.
5. The mark REJECTED – RESUBMISSION REQUIRED is a disapproval, and means that the submittal is deficient to the degree that the reviewer cannot correct the submittal with a reasonable degree of effort, has not made a thorough review of the submittal, and that the submittal needs revision and is to be corrected and resubmitted.
6. The mark NOT REVIEWED is acknowledgement of receipt and means that the submittal is for information and record purposes only.

D. Review stamps or other approval methods of the various designated approval authorities may not be the same as those of the District. The Contractor shall work with the various designated

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approval authorities and shall obtain approvals in the clearest and most straightforward manner possible.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 33 00

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Shop drawings.
- C. List of materials sources.
- D. Other submittals.
- E. Product data.
- F. Samples.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 DEFINITIONS

- A. Drawings: The term “Shop Drawings,” as used herein, includes fabrication, erection and installation, application, layout, and setting drawings, lists or schedules of materials and equipment, manufacturer’s standard drawings, wiring and control diagrams, all other drawings as may be required to show that the materials, equipment, and systems, and the positions thereof, comply with Contract requirements.
- B. Product Data: The term “product data,” as used herein, includes manufacturer-prepared descriptive literature, catalog sheets, brochures, performance data, test data, printed diagrams, schedules, illustrations, and other information furnished by the Contractor or the various product and materials suppliers to illustrate and describe a product, material, system, or assembly for some portion of the Work.
- C. Samples: The term “samples,” as used herein, are physical examples which illustrate materials, equipment, colors, textures, finishes, functions, configuration, and work quality, and establish the standards of quality and utility by which the Work will be judged for acceptance.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00, Submittal Procedures, for submittal procedures.
- B. Quantities:
 - 1. Three full size bond prints of each drawing.

2. Six copies of manufacturers' standard schematic drawings.
3. Four copies of Contractor's or manufacturers' calculations, and six copies of manufacturers' standard data.
4. Six copies of manufacturers' printed installation, assembly, erection, application, and placement instructions.
5. Three of each sample item specified in the various Specification Sections, unless otherwise specified.
6. Six copies of inspection reports, test reports, and certificates of compliance.
7. Where submittals are submitted to the Engineer for information or record purposes, submit two copies.
8. Where permits and licenses and other such documents are obtained in the District's name, submit the original and one copy.

1.05 SHOP DRAWINGS

A. Drawings shall be prepared in accordance with ANSI Y14, Drafting Standards Manual, and the following requirements:

1. Drawings shall be limited to the following standard sizes in inches: Maximum size shall be 22 inches by 34 inches.

<u>WIDTH (Vertical)</u>	<u>LENGTH (Horizontal)</u>
8 1/2 inches (215.9mm)	11.0 inches (279.4mm)
11.0 inches (279.4mm)	8 1/2 inches (215.9mm)
11.0 inches (279.4mm)	17.0 inches (431.8mm)
17.0 inches (431.8mm)	22.0 inches (558.8mm)
22.0 inches (558.8mm)	34.0 inches (863.6mm) (Maximum)

2. Each drawing shall have the following information in the title block.
 - a. Drawing number, date, title, revision number, and sheet number
 - b. Contract number, Contract sheet number, Contract page number.
 - c. Contractor's name.
 - d. Subcontractor/manufacturer name (if applicable)
 - e. Name of installation location.
3. Each drawing shall use symbols from one standard reference source. The Contractor shall furnish a complete symbol list that includes non-standard symbols used on the

drawing. Symbols used shall conform to the list of standard references as listed below:

- a. Institute of Electrical and Electronic Engineers (IEEE).
 - b. National Electric Manufacturer's Association (NEMA).
 - c. ANSI Y14: American National Standards Institute "Drafting Standards Manual".
 - d. ANSI Y10: American National Standards Institute "Letter Symbols for Drafting".
 - e. ANSI Y32: American National Standards Institute "Graphic Symbols for Drafting".
4. Each drawing shall include details necessary for the procurement, installation, maintenance, and repair of all components or facilities equipment provided. Change Order notices that are attached to drawings shall not constitute revised drawings. Each drawing shall include all changes and be upgraded to reflect the latest configuration.

C. Drawings shall be submitted in accordance with the following requirements:

1. The first drawings submitted by the Contractor will be reviewed for conformance to the requirements herein. Once approval is given, the Contractor shall use this approved drawing as the standard, and prepare subsequent drawings to a quality equal to or better than the approved standard.
2. Each drawing prepared and submitted for review shall have in the lower right hand corner, just above the title block, a five-inch square blank space in which the Engineer may indicate the action taken.
3. All final approved drawings and catalog cuts shall be submitted to the Engineer upon completion of the Work as specified in Section 01 78 39, Project Record Documents.

D. When specified, shop drawings shall be prepared and submitted electronically. Such drawings shall be created using AutoCAD in accordance with the District's Contract Drawing CADD Requirements (part of the BART Facilities Standards, Appendices, District Technical Manuals). Shop drawings to be prepared and submitted electronically include shop drawings which will be utilized as illustrations and drawings in Operation and Maintenance Manuals.

1. The initial submittal of such shop drawings shall include electronic copies for review of their conformance with applicable drafting standards. The Engineer will make the Contract Drawing CADD Requirements available upon request.

1.06 OTHER SUBMITTALS

- A. Other submittals shall be furnished upon request for the Engineer's approval to verify compliance of all equipment and materials with the Contract Documents. These submittals shall include in addition to drawings: catalog cuts, certifications of compliance, or any other substantiating information or samples of material items as necessary.

1.07 PRODUCT DATA

- A. The Contractor shall modify manufacturers' standard diagrams, charts, illustrations, brochures, calculations, schematics, catalog cuts, and other descriptive data to delete information which is not applicable to the Contract. The Contractor shall supplement standard information with additional information applicable to this Contract, and indicate dimensions, clearances, performance characteristics, capacities, wiring and other diagrams, and controls.
- B. If the Contractor utilizes drawings prepared by others, such drawings may include the standards and symbols of others if the drawings are a mix of existing product drawings and drawings prepared specifically for this Contract. In the event others provide drawings prepared specifically for this Contract, such drawings shall conform in symbols, media and standards to the Contractor's drawings.
- C. The Contractor shall modify the manufacturer's printed installation, erection, application, and placing instructions to delete information which is not applicable to the Contract.
- D. Submittals shall include the following:
 - 1. Date and revision dates.
 - 2. Contract title and number.
 - 3. Reference Contract Drawing numbers.
 - 4. Applicable Contract Specification Section numbers.
 - 5. Identification of product by either description, model number, style number, serial number, or lot number.
 - 6. The names of the Contractor, Subcontractors, Suppliers, and manufacturers as applicable.
 - 7. Applicable standards, such as ASTM or Federal specification numbers.
- E. Certificates of Compliance:
 - 1. The Engineer may permit the use of certain materials prior to sampling and testing if accompanied by a certificate of compliance stating that the materials involved comply in all respects with the requirements of the Contract Documents. The certificate shall be signed by the manufacturer of the material. A certificate of

compliance shall be furnished with each lot of material delivered to the Work, and the lot so certified shall be clearly identified in the certificate.

2. All materials used on the basis of a certificate of compliance may be sampled and tested at any time. The fact that material is used on the basis of a certificate of compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents. Any such material not conforming to such requirements shall be subject to rejection whether in place or not.
3. The Engineer reserves the right to refuse the use of material submitted for approval solely on the basis of a certificate of compliance.
4. The form of the certificate of compliance and its disposition shall be as approved by the Engineer.

1.08 SAMPLES

- A. The Contractor shall furnish to the Engineer samples required by the Contract Documents. Samples shall be submitted without charge, with shipping charges prepaid. Materials for which samples are required shall not be used in the Work until approved in writing by the Engineer.
- B. Sample Label: Each sample shall be labeled with the following data:
 1. Name, number, and location on project;
 2. Name of Contractor;
 3. Material or equipment represented, and location in the project;
 4. Name of producer, brand, trade name if applicable, and place of origin; and
 5. Date of submittal.
- C. The Contractor shall forward a letter in triplicate to the Engineer submitting each shipment of samples and containing the information listed on the Sample Label specified herein. Approval of a sample shall be only for the characteristics and use named in the submittal and approval, and shall not be construed to change or modify any Contract requirement. Before submitting samples, the Contractor shall assure itself that the materials or equipment will be available in the quantities required in the Contract, as no change or substitution shall be permitted after a sample has been approved unless such change or substitution is approved by the Engineer in writing.
- D. Samples of material from local sources shall be taken by or in the presence of the Engineer. Samples taken otherwise shall not be considered for testing.
- E. Inspection and tests will be made, but it is understood that such inspections and tests, if made at any point other than the point of incorporation in the Work, in no way shall be

considered as a guaranty of acceptance of any material which may be delivered later for incorporation in the Work.

- F. Approved samples not damaged in testing may be incorporated in the finished work if marked for identification and approved by the Engineer. Materials incorporated in the Work shall match the approved samples.
- G. Failure of any material to pass the specified tests shall be sufficient cause for refusal to consider, under the Contract, any further samples of the same brand, make, or source of that material. The Engineer reserves the right to disapprove any material which has previously proven unsatisfactory in service.
- H. Samples of material delivered to the site or installed in place may be taken by the Engineer for testing. Failure of samples to meet Contract requirements shall annul previous approvals of the item tested.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 33 23

SECTION 01 35 14

OPERATING SYSTEM INTERFACE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Site specific work plan.
- B. BART operating rules and procedures.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 DEFINITIONS

- A. Safety Monitor: A Qualified Person (see Operating Rules and Procedure Manual) assigned to oversee the operational safety of Contractor or other outside agency work activity. Safety Monitors shall have successfully completed Safety Monitor training and field certification.
- B. BART Operating System: Facilities, equipment and installations that are essential for normal revenue operation, including the BART trackway and equipment therein, traction power facilities, train control rooms, communications equipment, ventilation equipment, and other equipment and elements of infrastructure essential for normal revenue operation.
- C. BART Operating Envelope: That portion of the BART system within protective fencing, tunnels, tubes, subways, stations and aerial structures wherein trains operate. Operating Envelope shall be understood to include all areas with BART transit vehicle movement, including shops and yards.
- D. BART Train Clearance Envelope: The dynamic envelope within which BART trains operate.
- E. Revenue Hours: Hours during which passenger carrying trains operate as defined by the current schedule and which may be modified by the BART Operations Control Center (OCC).
- F. Window: District-approved time period during which active tracks are removed from service for construction purposes.
- G. Site Specific Work Plan (SSWP): A program, plan, and schedule prepared and submitted by the Contractor and approved by the Engineer, which accurately describes and illustrates the manner in which work that may affect the Operating System shall be accomplished within the District-approved windows.

1.04 SITE SPECIFIC WORK PLAN (SSWP)

- A. Obtain Engineer's approval of an SSWP prior to starting work that may affect the Operating System. Such work shall be performed either under an SSWP or with a barrier between the Contractor's operations and the operating system. Access to the BART Operating System shall be in accordance with an approved SSWP and the BART publication "Standard Procedure for Access to the BART Operating System". Such publication, further explanation of SSWP process, and sample SSWP's are available from the District upon request.
- B. The Contractor shall furnish all labor, materials, and equipment as required to perform and complete the work in the limited time available. The Contractor shall maintain the approved schedule in the SSWP.
- C. SSWPs that may impact normal functioning of any part of the Operating System shall include a detailed schedule for each activity in the SSWP. The schedule shall show the expected work progress for each activity on an hourly basis. The schedule shall include a time at which all activities planned under the SSWP will be completed. Failure of the Contractor to complete the scheduled activities by the planned time or to put in place an approved contingency plan so that the system is available for operations at the approved completion time shall make the Contractor liable for liquidated damages as specified in Contract Specifications Section 01 35 14 - Operating Systems Interface, for each hour or part of an hour that the operation of the system for passenger revenue service is delayed. These liquidated damages are distinct and separate from liquidated damages specified in Contract Specifications Section 01 11 00 - Summary of Work.
- D. The SSWP shall contain a description of any difference to the operating system between start and finish of the work. The SSWP shall show each activity and where and how it affects normal operation of the system. Each activity in the SSWP shall include all labor, materials, and equipment required to complete the activity within the District-approved time period (window).
- E. The SSWP shall include contingency plans for putting the system back in operation in case of an emergency and in case the Contractor fails to perform and complete the work in accordance with the approved schedule. Contingency plans shall address the various stages of construction.
- F. The SSWP shall be submitted to the Engineer at least six weeks prior to the proposed start of work covered by the SSWP. The Engineer may request explanations and changes to the SSWP to conform the SSWP to the Contract requirements. If the SSWP is not acceptable to the Engineer, the Contractor shall revise the SSWP to make it acceptable.
- G. Not less than one week prior to the scheduled start of work, the Contractor will be informed if the submitted SSWP is acceptable. Once the SSWP is approved, the Contractor shall assemble the resources necessary to perform the work represented by the SSWP. The necessary resources shall be available and demonstrated ready for use on the Friday of the work week. At that time, the Engineer will make a final decision as to whether or not the work is to proceed as planned or be canceled. The prime consideration will be the state of readiness of the Contractor. However, BART operation and maintenance plans may also affect the decision.

- H. If the Contractor is delayed by the District from performing the work and the Contractor has the necessary resources available and ready to perform the Work, the delay to the Contractor will be compensated as specified in Article GC8.4.3.
- I. References specified herein to weeks mean the week starting with Friday and the next six days of the proposed work schedule.
- J. The following types of work require an SSWP and a Window:
 - 1. Establishment of defined construction areas within the BART Operating Envelope including installation of construction fence and deactivation/cutover and maintenance of BART operating system.
 - 2. Resumption of BART operations within defined construction areas following completion of construction including reactivation/cutover and testing BART operating systems and removal of construction fence.
 - 3. Movement of construction equipment, materials and personnel within seven feet of active track centerline.
 - 4. Where Contractor's crane booms or jibs, concrete pump booms and other similar equipment, which during normal work operations will swing out over active yard tracks, an SSWP will be required. In developing this SSWP, the Contractor shall pay particular attention to describing the safeguards to be employed, e.g., how loads will be prevented from entering the operating envelope, how crane hooks, lifting gear and the like, will be kept away from BART equipment and installations. Where crane loads will enter the operating envelope, a Work Window will be required.
 - a. Where the Contractor's equipment could, through overturning or falling, accidentally enter into the operating envelope, the Contractor shall pay particular attention to ensure the stability of the equipment.
 - b. When construction is conducted above operating tracks, a plan for such operations shall be submitted by the Contractor and approved by the Engineer that demonstrates how the operating tracks will be protected from falling objects or debris, from water or other liquids that might otherwise drop onto tracks or BART vehicles.
 - 5. Work on electrical or computer systems that could affect BART Operations.
 - 6. Cranes, booms, jibs, or similar equipment within 10 feet of the side of any aerial track structure.

1.05 BART OPERATING RULES AND PROCEDURES

- A. Employees of the Contractor scheduled or expected to perform work within the Operating Envelope are required to have successfully completed, within the previous 12 months, BART's prescribed training program for performing work under BART's Operating Rules

and Procedures. The program is four hours in length. The Contractor shall keep records of those successfully completing the course.

- B. The District will provide training, and retraining every 12 months, for up to four supervisory-level personnel, one of whom shall be appointed the Contractor's Safety Representative for this Contract. The Contractor shall have at least two supervisors on the project at all times, one of whom shall be the Contractor's Safety Representative for this Contract. Both supervisors shall have successfully completed the District-provided training course within the previous 12 months. The course is 16 hours long, and the trainees must pass the required exams to successfully complete the course. The Contractor shall provide the same District-approved training for all other personnel expected to perform work within the operating envelope.
- C. A copy of the current BART Operating Rules and Procedures Manual (OR&P) will be made available to the Contractor. All activities within BART's operating envelope shall comply with the OR&P. Violations of the OR&P will subject the Contractor to prompt exclusion from the jobsite until the Contractor demonstrates knowledge of proper compliance procedures to the satisfaction of the District. Such exclusion from the jobsite will not be grounds for any additional compensation nor for any extension of the Contract completion time.

1.06 SYSTEM REACTIVATION SAFETY INSPECTION CHECKLIST

- A. In accordance with the District's policy, a System Reactivation Safety Inspection Checklist shall be developed prior to the return of any safety critical systems to service. The Contractor shall support the District and its representatives in preparing and implementing the Cutover Checklist to ensure the elimination or mitigation of identified potential hazards.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 35 14

SECTION 01 35 24

CONSTRUCTION SAFETY

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Contractor's safety program.
- B. First aid.
- C. Emergencies and emergency procedures.
- D. Protecting the general public.
- E. Specific requirements
- F. Inspections by outside agencies.
- G. Inspections by the District.
- H. Work performed near existing operating right-of-way
- I. Hazardous materials encountered during construction.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 SUBMITTALS

- A. Within 5 days of Execution of Contract:
 - 1. Submit for review and approval, the Contractor's proposed Safety Representative's resume identifying his or her work experience and qualifications. The minimum qualifications shall be five years of diversified construction safety experience, and two years experience related to the Contract's scope of work. The Contractor shall have received the Engineer's approval of the Contractor's proposed Safety Representative prior to submitting the first monthly progress payment.
- B. Within 7 days of Notice to Proceed:
 - 1. Submit two copies of the Contractor's Safety Program for review and approval. The Contractor shall have received the Engineer's approval of the Contractor's proposed Safety Program prior to submitting the first monthly progress payment.

1.04 CONTRACTOR'S SAFETY PROGRAM

- A. The Contractor's Safety Program shall incorporate the Contractor's safety practices and procedures, as well as the requirements described herein including the following:
 - 1. A disciplinary program.
 - 2. A policy that prohibits rough or boisterous play and activity, gambling, the use of alcohol or drugs, and the possession of weapons on the construction site.

1.05 FIRST AID

- A. The Contractor shall provide emergency medical services including American Red Cross certified First Aid Representative(s) on the jobsite and an appropriate area designated for first aid to treat injured employees. First Aid Representatives shall be CPR certified.
- B. Employees shall receive prompt first aid care when injured.

1.06 EMERGENCIES AND EMERGENCY PROCEDURES

- A. Develop Emergency Procedures for any event that may occur for the following categories:
 - 1. Fire;
 - 2. Employee injury;
 - 3. Property damage and damage to various utilities (such as, electrical, gas, sewage, water, telephone or public roadways);
 - 4. Earthquake;
 - 5. Public demonstrations;
 - 6. Bomb threats;
 - 7. Hazardous materials encountered;
 - 8. Toxic spills;
 - 9. Explosions; and
 - 10. Vehicular accidents.
- B. The Emergency Procedures shall include, but not be limited to, the following:
 - 1. Identification of the person responsible for handling an emergency.
 - 2. Establishment of teams for handling each type of emergency.
 - 3. Identification of the person responsible for making emergency call (preferably the ranking Supervisor present).
 - 4. The requirement to conspicuously post a list of an emergency phone numbers, along with information to be transmitted.
- C. Update the Emergency Procedures when necessary.
- D. Provide to the Engineer copies of the above Emergency Procedures.

- E. Contact the Engineer immediately in the event a serious accident should occur.
- F. Following an emergency, the Contractor shall:
 - 1. Secure the area as expediently as possible; and
 - 2. Provide only those authorized representatives of the District and specific governmental agencies an account of the nature of the emergency. Questions from media personnel shall be referred to the Engineer.
- G. Whenever the Contractor requires emergency services, such as ambulance, Fire Department or Police, the Contractor shall use the posted emergency numbers and also contact a District representative at:

(510) 834-1297 BART Central

1.07 PROTECTING THE GENERAL PUBLIC

- A. The Contractor shall take the necessary steps to prevent injury to the general public, BART employees, and BART patrons, or damage to public property. The public shall be considered as any persons not employed by the Contractor or its Subcontractors. The Contractor shall adhere to the following requirements:
 - 1. Work shall be performed outside of the designated work area only when specifically stated in writing from the Engineer.
 - 2. Necessary steps shall be taken to protect and maintain work areas that interface with public sidewalks, station entrances (lobbies, corridors and aisles), stairways, escalators, elevators, and station platforms.
 - 3. All travel ways, access and egress points shall be maintained and clear of obstructions at all times.
 - 4. Warning signs shall be conspicuously positioned and a flag person shall be assigned when the Contractor's equipment may be encountered by pedestrians or vehicles.

1.08 SPECIFIC REQUIREMENTS

- A. **Work Areas:** The Contractor shall provide a safe work area for its employees. When unsafe conditions do exist, immediate abatement is required.
- B. **Work Practices:** The Contractor shall be responsible for assuring that its employees work safely and use the appropriate personal protective equipment.
- C. **Weekly "Tool Box" Meetings:**
 - 1. The Contractor shall conduct weekly "tool box" meetings (15 minutes minimum) for all employees. The purpose of these weekly meetings is to:

- a. Discuss observed accident trends and causes.
 - b. Plan safety into the work activities.
 - c. Take action to correct workers' safety concerns.
 - d. Review emergency procedures with employees.
2. These meetings shall be documented and such documentation forwarded to the Engineer within one week of the meeting.
- D. Accident and Incident Reports: Provide Engineer with copies of all accident and incident reports within 24 hour of occurrence.
- E. Cal/OSHA Permit and Registration Requirements:
- Submit copies of permits from the California Division of Occupational Safety for the following:
1. Erection or demolition of any building, falsework, scaffolding, or structure the equivalent of three stories or higher.
 2. Performing any work related to hazardous materials.
- F. Personal Protective Equipment (PPE): The Contractor's personnel, without exception, are required to wear certain PPE. Among these are:
1. Hard hats and green safety vests - mandatory.
 2. Hearing protection - mandatory in all operations creating noise above 80dBA.
 3. Eye protection - mandatory when performing tasks producing flying debris or when handling any chemicals.
 4. Safety harness - meeting ANSI A10.14 and shall be worn and used when exposed to any fall of 4 feet or more in height, where the height cannot be properly guarded with rails or other means.
 5. Shoes - made of leather (if tunneling is performed, shoes shall be made of rubber with steel toes).
 6. Shirts - only those with sleeves allowed; no tank tops or mesh shirts are allowed.
 7. Respiratory protection - when required by law.

1.09 INSPECTIONS BY OUTSIDE AGENCIES

- A. The Contractor shall be subject to inspections by outside agencies, including Cal/OSHA. The Contractor shall notify the Engineer immediately should citations, warnings or safety violations be issued. Copies of same shall be provided to the Engineer within 48 hours.

1.10 INSPECTIONS BY THE DISTRICT

- A. The Contractor shall cooperate with designated District representatives when conducting site inspections.
- B. The District may periodically make quality assurance audits of the Contractor's Safety Program.

1.11 WORK PERFORMED NEAR EXISTING OPERATING RIGHT-OF-WAY

- A. For any construction equipment (such as cranes, concrete pump trucks, back hoes, and the like) that could encroach into the District's operating right-of-way, the Contractor shall submit, and obtain approval by the Engineer, a plan describing the use of such equipment, and the necessary precautions to be taken to preclude any accidental encroachment of the right-of-way.

1.12 HAZARDOUS MATERIALS ENCOUNTERED DURING CONSTRUCTION

- A. If unidentified contaminated materials are encountered during construction or an accident results in the release of hazardous materials, work shall be stopped and the area evacuated and secured. The Contractor shall immediately notify the Engineer. If necessary, the Contractor shall take precautions to limit the contamination to the jobsite.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 35 24

BART Facilities Standards (BFS)

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SECTION 01 35 54

IDENTIFICATION AND SECURITY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Identification and security requirements applicable to the Contractor's work within the Operating System as defined in Section 01 35 14, Operating System Interface, and non-public areas.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 IDENTIFICATION

- A. Within seven days of the date of the Notice of Award letter for this Contract, the Contractor shall submit a list of all employees of the Contractor and all employees of Subcontractors who may perform work on this Contract. The Engineer will contact the Contractor within seven days from submission to schedule an appointment with the BART Police Department for those individuals requiring the Contractor Photo ID badges as specified in this Section. The Contractor shall make an appointment date for all such individuals that is no more than seven days from the date of the Engineer's notification. Should the Contractor subsequently request additional identification badges for personnel not on the original list, the Contractor is cautioned that such badges may take up to 60 days to be approved. The Contractor shall not be entitled to any claim for additional compensation, damages, or schedule extension that may result from the failure of personnel to receive timely security clearances.
 - 1. Badges will not be required for nor issued to truck drivers delivering material or performing other trucking activities that require them to stay with their vehicle at all times.
- B. Contractor and Subcontractors personnel shall prominently display a valid, original District-issued identification badge while accessing and while performing work in areas in the Operating System and non-public areas whether part of the Operating System or elsewhere. Contractor and Subcontractor personnel are not allowed to perform work in these areas until all of the required identification, security, and background checks have been completed.
- C. The badge shall be clearly displayed and not obscured by any clothing or personal effects. Badges shall not be duplicated.
- D. The badge does not entitle the holder to transportation without charge on the BART System.

- E. The District issues two types of identification for construction contractors:
1. **Contractor Photo ID Badge:** Contractor Photo ID Badges are required for Contractors and Subcontractors working on District property for a period exceeding two weeks. The badge contains the individual's name, photograph, contract number, work location, expiration date, and current validation sticker.
 2. **Short Term Worker Identification Badge (C Badge):** C Badges are required for Contractors and Subcontractors assigned to a specific work site for a limited time period not to exceed two weeks within a ninety-day period. The badge contains a large black "C" on the face of the card, the contract number, expiration date, and serial number. There is no photograph or validation sticker on the C Badge.

1.04 IDENTIFICATION, SECURITY, AND BACKGROUND CHECKS

- A. Contractor shall ensure that individuals requiring Contractor Photo ID badges report to the designated BART Police office for processing at their scheduled appointment time. Individuals requiring Contractor Photo ID badges are subject to the following identification, security, and background checks:
1. Individuals shall provide valid and current photo identification, such as a California Driver's License, a California Identification Card, a U.S. Passport, or documentation from the U.S. Citizenship and Immigration Services (a Work Permit or an Alien Registration Card [Green Card]).
 2. The individual's photo identification will be matched against the Contractor's list of employees authorized to work on a particular job.
 3. The individual's identification will be matched against the FBI Watch List.
 4. The individual shall undergo a criminal history check administered through the BART Police Department (BPD). BPD will collect a set of fingerprint samples from the individual. The samples will be compared with the State of California's Department of Justice (DOJ) Criminal Offender Records System. Upon receipt of DOJ's response, BPD will notify the Engineer and appropriate departments of the results of the background check. DOJ records will be maintained by BPD and kept confidential to the extent permitted by law.
- B. Individuals requiring C Badges are subject to the following identification, security, and background checks:
1. Individuals shall provide valid and current photo identification, such as a California Driver's License, a California Identification Card, a U.S. Passport, or documentation from the U.S. Citizenship and Immigration Services (a Work Permit or an Alien Registration Card [Green Card]).
 2. The individual's photo identification will be matched against the Contractor's list of employees authorized to work on a particular job.
 3. The individual's identification will be matched against the FBI Watch List.

1.05 ADMINISTRATION

A. General

1. Badges will remain the property of the District and the privileges of use may be revoked as a result of invalidation, expiration, or confiscation.
2. The Contractor shall immediately notify the Engineer of any lost or stolen badges. A fee of \$100 will be charged for a replacement badge. Validation stickers will be replaced at no charge.
3. Stolen Badges: Upon receipt of a copy of an official police report on the loss by theft or robbery of a badge, a replacement badge will be issued as expeditiously as possible.
4. The Contractor shall return issued badge to the Engineer upon termination of Contractor or Subcontractor employee or expiration of badge. The Contractor shall return all issued badges to the Engineer upon completion of the Contract.

B. Daily Badge Administration:

1. The Contractor shall collect the badges daily until completion of the Contract.
2. The Contractor shall maintain an accurate and up-to-date list of individuals to whom badges have been issued. The list shall contain the name of each individual and the serial number of the badge. The Engineer will periodically check the Contractor's records to ensure accurate record keeping and tracking of badges.
3. Prior to the start of work each day, the Engineer will check the badges of all workers.

1.06 NONCONFORMANCE

- A. The absence of a valid Badge may be grounds for removal from District property. Such removal will not be grounds for any time extension or additional compensation.
- B. Failure to adhere to the requirements of this Section shall be grounds for revocation of badge privileges. The badge shall be surrendered to the Engineer for closer inspection or confiscation as required.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 35 54

BART Facilities Standards (BFS)

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SECTION 01 42 19

REFERENCE STANDARDS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Reference standard file
- B. Abbreviations

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 REFERENCE STANDARDS

- A. The Contract Documents contain references to various standard specifications, codes, practices, and requirements for materials, equipment, work quality, installation, inspections, and tests, which references are published and issued by the organizations, societies, and associations listed herein by abbreviation and name. Such references are hereby made a part of the Contract Documents to the extent specified in General Conditions Article GC1.5.
- B. Whenever a referenced standard contains administrative requirements, including measurement and payment provisions, such as the standard specifications of various government entities, utility districts, and other agencies, such administrative requirements shall not apply to the Work of this Contract. References to such standards shall be applicable to the pertinent technical provisions only.

1.03 REFERENCED STANDARDS FILE

- A. Referenced standards shall be obtained by the Contractor and maintained in the Contractor's office. Referenced standards shall be made readily available for use by the Engineer and the Contractor's staff in carrying out the quality assurance and quality control programs specified in the Contract Documents, and to assure compliance with the requirements of the codes, specifications, test methods, practices, and other standards referenced in the Contract Documents.

1.04 ABBREVIATIONS

- A. Wherever in the Contract Documents an organization's abbreviation or acronym is used, it shall be understood to mean the full name of the respective organization as specified in General Conditions Article GC1.2, as specified in the various Specification Sections, and as follows:
 - 1. AA Aluminum Association
 - 2. AABC Associated Air Balance Council
 - 3. AAMA American Architectural Manufacturers Association

REFERENCE STANDARDS

4. AAN American Association of Nurserymen
5. AAR Association of American Railroads
6. AASHTO American Association of State Highway and Transportation Officials
7. ACI American Concrete Institute
8. AFBMA Anti-Friction Bearing Manufacturer's Association
9. AIMA Acoustical and Insulating Materials Institute
10. AISC American Institute of Steel Construction
11. AISI American Iron and Steel Institute
12. AMCA Air Moving and Conditioning Association
13. ANSI American National Standards Institute
14. APA American Plywood Association
15. API American Petroleum Institute
16. AREMA American Railway Engineering and Maintenance off Way Association
17. ASHRAE American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
18. ASME American Society of Mechanical Engineers
19. ASQC American Society for Quality Control
20. ASTM American Society for Testing and Materials
21. AWPA American Wood Preservers Association
22. AWPI American Wood Preservers Institute
23. AWS American Welding Society
24. AWWA American Water Works Association
25. BHMA Builders' Hardware Manufacturers Association
26. BSI Building Stone Institute
27. Caltrans State of California, Department of Transportation
28. CLFMI Chain Link Fence Manufacturers Institute
29. CMAA Crane Manufacturer's Association of America

REFERENCE STANDARDS

30. CRSI Concrete Reinforcing Steel Institute
31. CS Commercial Standards, United States Department of Commerce
32. DHI Door and Hardware Institute
33. DOT United States Department of Transportation
34. DSI Dimensional Stone Institute
35. EEI Edison Electric Institute
36. EIA Electronic Industries Association
37. FGMA Flat Glass Marketing Association
38. FM Factory Mutual System
39. FS Federal Specification
40. FTA Federal Transit Administration
41. ICBO International Conference of Building Officials
42. IEEE Institute of Electrical and Electronics Engineers
43. IES Illuminating Engineering Society
44. IMSA International Municipal Signal Association
45. IPCEA Insulated Power Cable Engineers Association
46. ITE Institute of Traffic Engineers
47. JIC Joint Industrial Council
48. MIA Marble Institute of America
49. NAAMM National Association of Architectural Metal Manufacturers
50. NBFU National Board of Fire Underwriters
51. NEBB National Environmental Balancing Bureau
52. NEC National Electrical Code
53. NEMA National Electrical Manufacturers Association
54. NFPA National Fire Protection Association
55. NLMA National Lumber Manufacturers' Association

REFERENCE STANDARDS

- 56. NRCA National Roofing Contractors Association
- 57. NTMA National Terrazzo and Mosaic Association
- 58. PCA Portland Cement Association
- 59. PCI Precast/Prestressed Concrete Institute
- 60. PDI Plumbing and Drainage Institute
- 61. PG&E Pacific Gas and Electric Company
- 62. PS U. S. Product Standard
- 63. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.
- 64. SSPC Steel Structures Painting Council
- 65. SWI Sealant and Waterproofers Institute
- 66. TCA Tile Council of America
- 67. UBC Uniform Building Code of the International Conference of Building Officials
- 68. UL Underwriters Laboratories Inc.
- 69. UMC Uniform Mechanical Code
- 70. UPC Uniform Plumbing Code
- 71. USBPR United States Bureau of Public Roads
- 72. WCLA West Coast Lumbermen's Association
- 73. WCLIB West Coast Lumber Inspection Bureau
- 74. WH Warnock Hersey
- 75. WIC Woodwork Institute of California

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 42 19

SECTION 01 43 00

QUALITY ASSURANCE

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Work quality.
- B. Manufacturer's specifications and instructions.
- C. Specialist applicators/installer.
- D. Manufacturer's field services.
- E. Finished tolerances.

1.02 RELATED SECTIONS

- A. Field samples and site mockups are specified in Section 01 43 38 - Field Samples and Mockups.

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 WORK QUALITY

- A. Shop and field work shall be performed by mechanics, crafts-persons, artisans, and workers skilled and experienced in the fabrication and installation of the work involved. The Work shall be performed in accordance with the Contract Documents and the reviewed and accepted Shop Drawings.
- B. Work shall be erected and installed plumb, level, square, and true, or true to indicated angle, and in proper alignment and relationship to the work of other trades. Finished Work shall be free from defects and damage.

1.05 MANUFACTURERS' SPECIFICATIONS AND INSTRUCTIONS

- A. Unless otherwise indicated or specified, manufactured materials, products, processes, equipment, systems, assemblies, and the like shall be erected, installed, or applied in accordance with the manufacturers' instructions, directions, or specifications. Said erection, installation, or application shall be in accordance with printed instructions furnished by the manufacturer of the material or equipment concerned for use under conditions similar to those at the jobsite.
- B. Any deviation from the manufacturers' printed installation instructions and recommendations shall be explained and acknowledged as correct and appropriate for the circumstances, in writing, by the particular manufacturer. The Contractor will be held responsible for installations contrary to the respective manufacturers' instructions and recommendations.

1.06 SPECIALIST APPLICATOR/INSTALLER

- A. Materials, equipment, systems, and assemblies requiring special knowledge and skill for the application or installation of such materials, equipment, systems, or assemblies shall be applied or installed by the specified product manufacturer or its authorized representative or by a skilled and experienced Subcontractor qualified and specializing in the application or installation of the specified product.
- B. The installation Subcontractor shall be approved by the product manufacturer, as applicable.

1.07 MANUFACTURERS' FIELD SERVICES

- A. The Contractor shall have the manufacturer of a product, system, or assembly that requires special knowledge and skill for the proper application or installation of such product, system, or assembly provide appropriate field or job service at no additional cost to the District. The Contractor shall have the manufacturer inspect and approve the application or installation work.
- B. The Contractor shall make all necessary arrangements with the manufacturer of the products to be installed to provide onsite consultation and inspection services to assure the correct application or installation of the product, system, or assembly.
- C. The manufacturer's authorized representative shall be present at the time any phase of this work is started.
- D. The Contractor shall have the manufacturer inspect and approve all surfaces over which, or upon which, the manufacturer's product will be applied or installed.
- E. The Contractor shall have the manufacturer's representative make periodic visits to the site as the work progresses as necessary for consultation and for expediting the work in the most practical manner.

1.08 FINISHED TOLERANCES

- A. Except as specified otherwise in the individual Specifications Sections, finished tolerances shall conform with the following requirements:
 - 1. Walls: Finished wall surfaces shall be plumb and shall have a maximum variation of 1/8 inch in 8 feet when a straightedge is laid on the surface in any direction, and no measurable variation in any 2-foot direction.
 - 2. Ceilings: Finished ceiling surfaces shall present true, level, and plane surfaces, with a maximum variation of 1/8 inch in 8 feet when a straightedge and water level are laid on the surface in any direction, and no measurable variation in any 2-foot direction.
 - 3. Concrete Floors: Tolerances for concrete floors and pavement are specified in Section 03 35 00 - Concrete Finishing.

QUALITY ASSURANCE

4. Finished Floors: Finished floors shall be level to within plus or minus 1/8 inch in 10 feet. Where floor drains occur, slope finished floor to the drain at the rate of 1/8 inch per foot or as otherwise indicated on the Contract Drawings.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 43 00

BART Facilities Standards (BFS)

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SECTION 01 43 38

FIELD SAMPLES AND MOCK-UPS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Field samples and mock-ups.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 FIELD SAMPLES AND MOCK-UPS

- A. Field samples and mock-ups shall be prepared at the jobsite by the Contractor as specified in the various Sections of these Specifications. Affected finish work shall not be started until the Engineer has approved the field samples and jobsite mock-ups in writing.
- B. Construct and prepare field samples and jobsite mock-ups at designated locations at the jobsite or on the structure as directed by the Engineer.
 - 1. The Contractor shall have product manufacturers inspect and approve field samples and mock-ups, that involve their materials, for proper application or installation of the materials in accordance with their respective instructions and recommendations for the conditions or circumstances involved in the application or installation.
 - 2. The Contractor shall make arrangements with the respective product manufacturers to provide job or field service as specified in Section 01 43 00 - Quality Assurance.
- C. Construct or prepare as many additional samples and mock-ups as may be required, as determined by the Engineer, until desired features, textures, finishes, and colors are obtained. Approved samples and mock-ups shall serve as the standards of quality for the various affected units of work.
- D. Preserve approved field samples and mock-ups for comparison purposes until the affected work is completed and accepted by the District. Finished work shall match the approved field samples and mock-ups.

1.04 NONCONFORMANCE

- A. Completed work that does not exactly match approved field samples and mock-ups will be rejected, and shall be replaced with work that does exactly match the approved field samples and mock-ups at the Contractor's expense.
- B. If the Contractor elects to start work before the Engineer has approved the related field samples or mock-ups, the Contractor does so at the risk of having the work rejected by the Engineer without compensation.

1.05 REMOVAL AFTER COMPLETION

- A. Field samples and mock-ups shall be removed from the jobsite and structures after completion and acceptance of the affected work or otherwise as directed by the Engineer.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 43 38

SECTION 01 45 00

QUALITY CONTROL

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Contractor's construction quality plan.
- B. Contractor's quality control representative.
- C. Engineer's monitoring.
- D. Engineer's inspections and tests.
- E. Contractor's quality control testing.
- F. Test reports.
- G. Quality control audits.
- H. Certificates of compliance.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.
- B. Construction Quality Plan: Submit the Contractor's proposed Construction Quality Plan in advance of the Pre-Construction meeting specified in Section 01 31 19 - Project Meetings. The Contractor's Construction Quality Plan will be reviewed by the Engineer, who will provide comments to the Contractor within 20 days after its submittal. The Contractor shall revise its plan in accordance with the review comments and resubmit as required. The Contractor shall perform the Work in accordance with the approved plan.
- C. Construction Quality Control Representative: Submit to the Engineer for approval, within ten days after the effective date of the Notice to Proceed, the name, qualifications, experience, and resumé of the Contractor's proposed Construction Quality Control Representative as specified in Article 1.06 herein.

1.04 SOURCE OF MATERIALS

- A. In accordance with Section 01 33 23 - Shop Drawings, Product Data, and Samples, the Contractor shall notify the Engineer in writing of the sources from which the Contractor proposes to obtain materials requiring District approval, certification, or testing.

1.05 CONTRACTOR'S CONSTRUCTION QUALITY PLAN

- A. The Contractor shall prepare a Construction Quality Plan which shall identify the Contract quality requirements for each activity and describe how the Contractor intends to furnish that quality, including control testing, certifications, and records which the Contractor intends to provide.
- B. The Contractor shall obtain approval from the Engineer of the Construction Quality Plan within 60 days after the Contractor's receipt of the Notice to Proceed. The Contractor shall obtain approval from the Engineer for Quality Plans for early activities prior to the start of such activities. Such plans shall be incorporated later in the overall Construction Quality Plan. The Construction Quality Plan shall include, but not be limited to, the following elements:
 - 1. Training of personnel;
 - 2. Installation, inspection, examination, and test control;
 - 3. Control of measuring and test equipment;
 - 4. Material control;
 - 5. Control of non-conforming items;
 - 6. Subcontractor controls;
 - 7. Supplier and vendor controls;
 - 8. Documentation and records control;
 - 9. Special process control; and
 - 10. Facility turnover.

1.06 CONTRACTOR'S QUALITY CONTROL REPRESENTATIVE

- A. The Contractor shall assign a Quality Control Representative to monitor the quality of construction activities.
- B. In addition to persons performing or directly supervising the Work, the Contractor shall use qualified persons for quality verification and audits. These employees shall be free from the pressure of costs, construction scheduling, and production, and shall have the necessary authority to perform their roles effectively.
- C. The Contractor shall define the responsibility and authority of personnel primarily responsible for performing quality verification and audits. Include responsibility and authority to perform the following:
 - 1. Identify and record nonconforming items or conditions;
 - 2. Initiate and recommend correction through appropriate channels;
 - 3. Verify correction or implementation of solutions to correct nonconforming items or conditions; and
 - 4. Prevent or control further nonconformance.

1.07 ENGINEER'S MONITORING

- A. The Engineer will perform surveillance inspection of the Contractor's on-site construction activities. Surveillance inspection consists of a review, observation, or inspection of Contractor personnel, material, equipment, processes, and test results, performed at random or at selected

stages of the construction operations. The purpose of surveillance inspection is to determine if an action has been accomplished or if documents have been prepared in accordance with selected requirements of the Contract Documents.

- B. The Contractor shall provide access to the Work and shall furnish the Engineer reasonable facilities for obtaining such information as may be necessary to be fully informed of the quality and progress of the Work.
- C. Surveillance inspection does not take the place of the Contractor's quality programs or assume any responsibility for such programs or the quality of the Work. The Contractor shall establish its own quality program, perform the required inspections, and provide the necessary documentation to assure that acceptable quality has been achieved. The Contractor is responsible for specifying and controlling the quality of work performed by its Subcontractors.

1.08 ENGINEER'S INSPECTIONS AND TESTS

- A. The Engineer may perform inspections and tests as necessary to determine the Contractor's compliance with Contract requirements. The Engineer may perform such additional inspections and tests as it deems necessary to verify compliance with Contract requirements.
- B. For inspections and tests by the Engineer, the Engineer will provide the services of a qualified testing laboratory, soils engineer, or inspector, selected and paid for by the District.
- C. The District-employed testing laboratory will supervise the preparation and selection of samples required for testing.
- D. The Contractor shall provide such facilities and assistance as the testing laboratory may require for obtaining the necessary samples.

1.09 CONTRACTOR'S QUALITY CONTROL TESTING

- A. Scope: The Contractor shall perform quality control inspections and tests as necessary to ensure compliance with Contract requirements.
- B. Testing Services:
 - 1. Quality control testing is the testing of materials prior to their delivery from a manufacturer, or during construction, such as soils compaction tests, load tests, concrete tests during placement, concrete strength tests, pipe leakage tests, and such other tests as are specified in the various Sections of the Specifications to ensure compliance with the Contract Documents. The Contractor shall assume full responsibility for quality control testing and shall give sufficient notice to the Engineer to permit the Engineer to witness the tests. Quality control testing shall be at the expense of the Contractor and shall be performed by a Contractor-employed independent testing firm.
 - 2. The Contractor shall submit the name, address, and qualifications, together with the scope of proposed services, of the proposed testing firm to the Engineer for approval at least 30 days prior to the scheduled commencement of any work involving such testing. Should the Contractor desire to use more than one firm for quality control testing, the required information shall be submitted for each such proposed firm.

- C. Laboratory Tests: All laboratory testing shall be performed by an independent, qualified testing laboratory approved by the Engineer. The selected laboratory shall employ the proper equipment and qualified testing personnel for the testing specified in these Specifications. The Contractor shall obtain the Engineer's approval of the testing equipment and personnel. The Engineer may monitor the operations to ensure that tests are being performing in accordance with approved procedures and in compliance with these Specifications.
- D. Qualification of Laboratory Testing Personnel: Personnel performing laboratory tests shall be qualified for such work by virtue of prior experience and training.
- E. Testing Equipment: Testing equipment shall be in satisfactory operating condition, of adequate capacity and range, and accurately calibrated. Testing equipment shall be calibrated in accordance with national standards which are certified by the National Institute of Standards and Technology. Testing equipment shall be calibrated at the frequency recommended by the equipment manufacturer.
- F. Test Program Plan:
 - 1. A Test Program Plan shall be prepared, identifying the approach for accomplishing each of the specified tests. A narrative shall be prepared for each test specified, describing the test set-up, equipment, and instrumentation that will be used; procedure to be implemented; and the anticipated, as well as acceptable, test results. Drawings showing the relationship of the test sample and all significant components of the test equipment shall be included, as necessary, to describe the test set-up and procedure. The Test Program Plan shall include the test sequencing.
 - 2. Equipment specifications and calibration methods for all testing equipment shall be included in the Test Program Plan.
 - 3. Identity and qualifications of personnel who will perform testing shall be included in the Test Program Plan.
 - 4. The Test Program Plan shall include the proposed format for reporting test data.
 - 5. The projected schedule for test procedure submittals, test executions, and test results' report submittals shall be included in the Test Program Plan.
 - 6. After approval of the Test Program Plan, any proposed changes will require approval of the Engineer prior to implementing the change.

1.10 TEST REPORTS

- A. Within five days after completion of testing performed by or for the Contractor, submit test results of such tests to the Engineer. Identify test reports with the information specified for submittals in Section 01 33 00 - Submittal Procedures, and, additionally, the name and address of the organization performing the test, and the date of the tests. Test reports shall include the following information:

QUALITY CONTROL

1. Actual test results compared with the Contract requirements and identification of all non-conforming items.
 2. Calibration Certificates.
- B. The Engineer will make available to the Contractor copies of all test reports of tests performed by the Engineer.

1.11 QUALITY CONTROL AUDITS

- A. The Engineer may perform quality control audits of the Contractor's, Subcontractor's, and Supplier's quality records and performance. The Contractor shall ensure that all quality control records and places of work are open and available to the Engineer for inspection. The Engineer will give 30 days notice of intention to audit specific activities or installations.
- B. The Contractor, Subcontractor, or Supplier being audited shall be available during the audit as required by the audit team.

1.12 CERTIFICATES OF COMPLIANCE

- A. The Contractor may use certificates of compliance for certain materials and products in lieu of the specified sampling and testing procedures. Submit any certificates required for demonstrating proof of compliance of materials with specification requirements with each lot of material delivered to the Work. The lot so certified shall be clearly identified by the certificate. Certificates shall be signed by an authorized representative of the producer or manufacturer and shall state that the material complies in all respects with Contract requirements.
- B. The Project CPM Schedule specified in Section 01 32 16 - Construction Progress Schedule, shall indicate the date scheduled for the submittal of certificates. In the case of multiple shipments, each of which shall be accompanied by a certificate of compliance, the scheduled date on the Project CPM Schedule shall indicate the initial submittal only.
- C. The certificate of compliance shall be accompanied by a certified copy of test results or shall state that such test results are on file with the producer or manufacturer and shall be furnished to the District on request. The certificate shall give the information specified for submittals in Section 01 33 00 - Submittal Procedures, the name and address of the organization performing the tests, the date of the tests, and the quantity of material shipped.
- D. Materials used on the basis of a certificate of compliance may be sampled and tested by the Engineer at any time. The fact that material is used on the basis of a certificate of compliance shall not relieve the Contractor of its responsibility for incorporating material in the Work which conforms to the requirements of the Contract, and any such material not conforming to such requirements will be subject to rejection, whether in place or not.
- E. The District reserves the right to refuse to permit the use of certain materials on the basis of a certificate of compliance.

QUALITY CONTROL

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 45 00

SECTION 01 45 24

TESTING PROGRAM REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Data to be recorded.
- B. Training.
- C. Tests.

1.02 RELATED SECTIONS

- A. General requirements for training of BART personnel in the operation and maintenance of the various project electrical systems are specified in Section 01 79 00 - Demonstration and Training.

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 COORDINATION

- A. Submit written notice as to when the installed systems will be tested so that the Engineer can be present to witness the tests. Give a minimum of 15 calendar days notice before performing the proposed tests.
- B. Where specialized or heavy electrical equipment is involved, a representative of the manufacturer will be required to be present to witness the tests and verify the results.

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Testing Program: Submit overall test schedule and test procedures for review before beginning the testing of the systems. Each procedure shall include the following:
 - 1. Statement of procedure objective and scope;
 - 2. List of equipment required to set up and perform the procedure;
 - 3. List of equipment or services required from areas outside the Contractor's authority;
 - 4. List of prerequisite tests that need to be completed before the procedure can be performed;
 - 5. Description of the required procedure setup, including diagrams illustrating test equipment connections and identifying test points, where applicable;
 - 6. Step-by-step instructions for performing the procedure identifying the points where data is to be recorded and the limits for acceptable data;

TESTING PROGRAM REQUIREMENTS

- 7. Provisions for recording pertinent test conditions and environment at time of test; and
- 8. Instructions for recording data on data sheets and verifying that procedure steps have been completed.

- C. Test Reports: Submit certified test reports of the results of tests performed on installed systems.
- D. Instruments: Submit list of instruments and certification indicating that the instruments that will be used for testing have been calibrated and their accuracy certified within a previous period of not more than six months. List types of instruments to be used, manufacturer, serial number, latest date of calibration, and calibration organization.

1.06 GUARANTY

- A. Tests shall not alter the Contractor's guaranty of the equipment. Replace and retest work and materials found to be in noncompliance with these Specifications at no additional cost to the District.

1.07 DATA TO BE RECORDED

- A. Maintain reproducible test data sheets showing results of tests specified in the accepted test procedures. Provide reproducible data sheets, listing acceptable or specified test limits and values actually measured. Furnish one copy to the Engineer. Retain one copy.
- B. Provide data sheets showing test set-up, equipment used, names of persons performing test, names of witnesses, date, location, and serial number of equipment under test. Test data sheets shall be reviewed by the Engineer, and the Engineer may accept the test data sheets as submitted, or additional tests may be required. If additional tests are required because initial test results do not comply with these Specifications, the re-testing shall be documented and submitted as before at no additional cost to the District.

1.08 TRAINING

- A. Provide training for BART operating and maintenance personnel as specified in Section 01 79 00 - Demonstration and Training, and as follows:

<u>Equipment/System</u>	<u>Training Time (hrs)</u>
*Standby Generator	4
*Fire Alarm	8
Access Control	2
Support Annunciator Panel	2
Lighting Control Panels	2
Train Control Rm. -Temp Control Panel	2

* Training shall be on-site and shall include training by the respective manufacturer's representative where marked with an asterisk.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND SERVICES

- A. Provide test procedures, qualified technical personnel, tools, equipment, test instruments, facilities, and services as required to perform the testing. The Engineer will have qualified witnesses present at each test to observe the test and to certify recorded results.
- B. For the extended coverage, provide qualified technical support personnel, tools, test instruments, and services on demand when given at least 24 hours notice.
- C. The Contractor shall be present at all tests performed by others.
 - 1. Verify that the interface parameters sought are in compliance with the test data sheets accepted by the Engineer; or
 - 2. Perform work as necessary to ensure that the accepted interface parameters are met.

PART 3 - EXECUTION

3.01 TESTS

- A. Grounding System Verification: Verify and test that the grounding system is installed as indicated, and that resistance to earth does not exceed five ohms.
- B. Auxiliary Electrical Distribution System Conductor Insulation Test: Measure insulation resistance of major feeders in auxiliary electrical distribution system and compare measured values against ten megohms value.
- C. Auxiliary Electrical Distribution System Equipment Readiness: Verify by testing that auxiliary power equipment can be energized.
- D. Auxiliary Electrical Distribution System Operability Test and Switchboard Breakers: Perform testing of operation in accordance with Specification requirements.
- E. Auxiliary Electrical Distribution System Verification of Service to Train Control Room and Traction Power Substation: Verify by testing that the required auxiliary electrical service is available in the Train Control Room and Traction Power Substation.
- F. Auxiliary Electrical Distribution System Verification of Service to Escalators, Elevators, and Fare Collection Distribution Panel: Verify that auxiliary electric service is available to escalators, elevators, and fare collection distribution panels.
- G. Lighting and Receptacle System Operability: Verify by testing the operability of all lighting and receptacle circuits.
- H. Auxiliary Electrical Emergency Power System: Verify by testing the operability of the standby electrical emergency power system (uninterruptible power system) in accordance with Specification requirements.

TESTING PROGRAM REQUIREMENTS

- I. Verification of Service to and Control of Illuminated Signs: Verify by testing that power and control circuits are available for illuminating signs.
- J. Verification and Testing for Electrical Door Strikes and Door Position Indicators: Verify by testing the integrity and operation of electric door strikes and door position indicators.
- K. Auxiliary Electrical Supervisory and Control System: Simulate testing remote control and indication to ensure operability of auxiliary equipment and systems for interface.

END OF SECTION 01 45 24

SECTION 01 51 00

TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Temporary electrical facilities.
- B. Temporary water.
- C. Temporary heat.

1.02 RELATED SECTIONS

- A. Temporary toilet conveniences, washing facilities, and drinking water are specified in Section 01 52 00 - Construction Facilities.

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 REFERENCES

- A. State of California, Department of Transportation (Caltrans), Standard Specifications:
Section 86 Signals, Lighting and Electrical Systems

1.05 TEMPORARY ELECTRICAL FACILITIES

- A. Electrical Services: Provide and maintain during the course and progress of the Work all electrical power and wiring requirements to facilitate the work of all trades and services associated with the Work. Electrical power shall be provided at the Contractor's expense. The Contractor shall request the utility company to install temporary power poles in locations required. All temporary wiring, feeders, and connections shall be furnished by the Contractor, as required.
- B. Falsework Lighting: Falsework lighting shall comply with the requirements of Caltrans Standard Specifications, Article 86-6.11, "Falsework Lighting." The Contractor shall submit a plan of the proposed falsework lighting installations in accordance with the submittal requirements of Section 01 33 00 - Submittal Procedures.

1.06 TEMPORARY WATER

- A. Provide temporary water service as required for the Work, at the Contractor's expense. Closest availability of water shall be determined by the Contractor and shall be approved by authorities having jurisdiction before making the connection.

TEMPORARY UTILITIES

- B. Provide temporary piping or hose to carry water to every point where needed. All water used shall be potable water, unless otherwise approved by the jurisdictional authority for a specific purpose.

1.07 TEMPORARY HEAT

- A. Provide, at the Contractor's expense, temporary heat as necessary for drying out the station facilities and other structures, curing of concrete, the proper installation of materials, and the protection of the Work, materials, and workers against injury from dampness and cold.
- B. Fuel, equipment, and methods of heating shall be approved by the jurisdictional fire marshal before using.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 CLEANUP

- A. Remove all materials and equipment as a part of final cleanup.

END OF SECTION 01 51 00

SECTION 01 52 00

CONSTRUCTION FACILITIES

PART 1- GENERAL

1.01 SECTION INCLUDES

- A. Temporary sanitary facilities.
- B. Engineer's field office.
- C. Contractor's field office.
- D. Storage and parking areas.
- E. Enclosed storage and shops.
- F. Protective barricades and safety precautions.
- G. Temporary fencing.
- H. Security.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 GOVERNING LAWS

- A. Temporary facilities shall be in compliance with applicable federal, state, county, municipal, and local utility laws, rules, and regulations. Nothing in these Contract Documents shall be construed to permit work not conforming with such codes and regulations.

1.04 TEMPORARY SANITARY FACILITIES

- A. Provide adequate temporary toilet conveniences, washing facilities, and drinking water for the use of all employees and persons engaged on or about the Work, including Subcontractors and their employees. Drinking water shall be potable, and drinking water facilities shall be clean and sanitary.
- B. Locate sanitary facilities where approved by authorities having jurisdiction and maintain in a clean and sanitary condition during the course of the Work. Keep such facilities adequately supplied with toilet paper, paper toweling, paper cups, and related supplies as required.
- C. At completion of the Work, sanitary facilities shall be properly disinfected and all evidence of same removed from the site.

1.05 ENGINEER'S FIELD OFFICE**A. Requirements:**

1. Provide mobile units or temporary buildings, with water, sanitary facilities, electrical power, and parking facilities, hereinafter called the "Engineer's field office," for use of the Engineer and District representatives in administering the Contract. The Engineer's field office shall be situated in the work area at a location approved by the Engineer, adjacent to the Contractor's field office. The Engineer's field office shall be completely furnished and ready for occupancy by the District within 30 days after the effective date of the Notice to Proceed.
2. The Engineer's field office shall be maintained and serviced by the Contractor, as herein specified, until the final invoice has been submitted by the Contractor and approved by the District, as set forth in General Conditions Article GC9.8.1. The Contractor shall then remove or dispose of the field office off the site at Contractor's expense.
3. Mobile units shall have all the features specified herein. If the Contractor elects to provide a building or buildings in lieu of mobile units, the buildings shall conform to local building codes and shall have the basic features specified herein, with substitute materials allowable subject to approval of the Engineer.

B. Construction and Materials: Obtain and pay all costs for hauling, building, and connection permits. The field office shall be substantially constructed to provide office space for the construction time period specified in the Contract Specifications. All materials shall be good commercial quality. The amount of space (square feet) required for the Engineer's field office is specified in the Contract Specifications. As a minimum, provide the following features and facilities:

1. Exterior and interior surfaces, other than factory finished, painted with two coats of an approved paint of a color or colors approved by the Engineer. No painting will be required on aluminum or stainless steel surfaces.
2. Interior walls and ceilings paneled with finished plywood or gypsum wallboard of not less than one-half inch thickness, or other suitable material.
3. Floors covered with resilient flooring material such as vinyl composition tile or sheet vinyl flooring. Floors shall be constructed to withstand a live load of 50 psf.
4. Two rest rooms minimum, each with lavatory, water closet, mirror, soap holder, toilet paper holder, and paper towel dispenser. Provide one rest room (men's) with urinal. Both rest rooms shall comply with State and Federal accessibility requirements. Water supply may be from a self-contained water storage tank, and water closets may be self-contained, flushing chemical units. Lavatory, urinal, and water closet waste may drain into a self-contained holding tank.
5. Entrance doors shall comply with applicable State and Federal accessibility requirements.
6. Lighting of 100 foot-candles minimum at desk height uniformly in all areas except rest rooms. Provide rest rooms with adequate lighting.

7. Duplex electrical receptacles around interior walls at an approximate spacing of 10 feet on center.
 8. An electric drinking fountain for furnishing cool water. Water supply for drinking fountain may be bottled drinking water.
 9. An automatically controlled heating/cooling system.
 10. Water, sewer, telephone and facsimile (FAX) service (separate telephone lines), and electrical utility connections as required.
 11. Adequate access from public streets shall be provided to the field office, together with parking spaces as specified in the Contract Specifications. Include spaces for handicapped parking stalls as specified in the Contract Specifications. The access roadway and parking area shall be graded for drainage and surfaced with temporary concrete or asphalt pavement in an approved manner.
- C. Furnishings and Equipment: Provide furnishings, equipment, and appliances as specified in the Contract Specifications.
- D. Services: Provide maintenance, utility, and janitorial services throughout the specified period as follows:
1. Repair and daily cleaning of the field office, parking, and access area.
 2. The furnishing of drinking water, paper cups and towels, toilet paper, light bulbs, and such other basic necessities required for the operation and maintenance of the field office. For mobile units with holding tanks, provide periodic removal of waste material and cleaning of holding tank as required. Provide self-contained water storage tank with fresh, potable water as required. Refill when tank is down to 1/4 full.
 3. Provide security measures and area protection equivalent to that used by the Contractor for the Contractor's jobsite shop and field office facilities.
 4. Provide services for utilities indicated in Article 1.05.B.10, including monthly charges, account fees, service charges, connection fees and deposits. Telephone service shall include long distance costs.

1.06 CONTRACTOR'S FIELD OFFICE

- A. The Contractor shall provide and maintain, in good condition, on the site or near the site as approved by the Engineer, a temporary field office of suitable size for construction administrative operations and consultations with representatives of the District.
- B. The Contractor's field office shall contain a complete set of Contract Documents.
- C. The Contractor shall make arrangements and pay all costs, including service and toll charges, until Substantial Completion of the Work, for temporary telephone service in the temporary field office, for use by the Contractor and Subcontractors, for purposes related to the Work.

- D. If no Engineer's field office is required, the Contractor's field office shall include the following for the exclusive use of the Engineer:
1. A minimum 30 inches by 60 inches metal table with four chairs.
 2. A lockable metal two drawer filing cabinet. Furnish the Engineer with two sets of keys. The Contractor shall not retain any key to this cabinet.

1.07 STORAGE AND PARKING AREAS

- A. The Contract Drawings may indicate work areas available to the Contractor for storage of materials and for parking of construction equipment. If so indicated, these areas will be provided to the Contractor for the durations indicated in the Contract Specifications. Additional work and storage space, if required, shall be provided by the Contractor at Contractor's expense.
- B. The Contractor shall provide parking facilities for the Contractor's personnel, Subcontractors, supplier's delivery vehicles, and authorized visitors. Off-site parking facilities (if any) shall not impair or interfere with existing community parking and traffic conditions, regulations, and restrictions.

1.08 ENCLOSED STORAGE AND SHOPS

- A. The Contractor shall provide all temporary storage and shop rooms that may be required at the jobsite for safe and proper storage of tools, materials, and equipment. Construct such rooms only in locations indicated or as approved by the Engineer, and so as not to interfere with the proper installation and completion of other work.
- B. Remove such rooms within three days of receipt of notices from the Engineer that removal is necessary, and incur all expenses for such removal.
- C. Storage of gasoline or similar fuels shall conform to NFPA regulations and local fire department regulations and shall be confined within definite boundaries apart from buildings as approved by the Engineer and the jurisdictional fire marshal.

1.09 PROTECTIVE BARRICADES AND SAFETY PRECAUTIONS

- A. Construct and maintain barricades, lights, shoring, and warning signs as required by Federal and State safety ordinances and as required to protect the District's property from injury or loss and as necessary for the protection of the public and adjacent properties. Provide walks around obstructions made in a public place for prosecuting the Work. Leave all protection in place and maintain until removal is authorized.
- B. Guard and protect all workers, pedestrians, and the public from excavations, construction equipment, obstructions, and other dangers with adequate railings, guard rails, temporary walks, barricades, warning signs, directional signs, overhead protection, planking, decking, danger lights, and other suitable safeguards.
- C. Flaggers shall be provided to direct or divert pedestrian or vehicular traffic when necessary as specified in Section 01 57 00 - Temporary Controls.

- D. Additional safety requirements are specified in Section 01 35 24 - Construction Safety.

1.10 TEMPORARY FENCING

- A. The Contractor shall furnish, construct, maintain, and later remove temporary fencing around the jobsite perimeter as indicated.
- B. Except as otherwise specified herein, temporary fencing shall conform to Specifications Section 32 31 13 - Chain Link Fences and Gates.
- C. Used materials may be employed for temporary fencing, provided such used materials are good, sound, and are suitable for the purpose intended.
- D. Fencing materials may be commercial quality, provided the dimensions and sizes of said materials are equal to, or greater than, the dimensions and sizes indicated in Specifications Section 32 31 13 - Chain Link Fences and Gates. Additional fencing options include the following:
 - 1. Posts may be either metal or wood.
 - 2. Galvanizing and painting of steel items will not be required.
 - 3. Treating wood with wood preservatives will not be required.
 - 4. Concrete footings for metal posts will not be required, except where portable footings are required for temporary anchorage of posts.
- E. Temporary fencing that is damaged from any cause during the progress of the Work shall be repaired or replaced by the Contractor at no additional cost to the District.
- F. When no longer required for the Work, temporary fencing shall be removed. Removed fencing and related materials shall become the property of the Contractor and shall be removed from the jobsite, except as otherwise provided herein.
- G. Holes caused by the removal of temporary fences shall be properly filled to match adjacent surfaces.

1.11 SECURITY

- A. The Contractor shall provide for security of the Work and the jobsite until final inspection and Acceptance of the Work. Storage areas shall be suitably fenced and lighted and routinely patrolled by security guards.
- B. The District assumes no responsibility for protection of structures and finished work or for loss of materials and equipment from the time that Contract operations have commenced until Acceptance of the Work.
- C. If watchman service is deemed necessary by the Contractor, such protection shall be provided by the Contractor, and all costs therefore shall be paid for by the Contractor.

- D. Damaged, lost, or stolen materials and equipment, whether or not stored or already installed, shall be replaced by the Contractor with new specified materials and equipment, including reinstallation where applicable, at no additional cost to the District.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 CLOSEOUT

- A. Upon completion of the Work, or prior thereto when required by the Engineer, remove temporary facilities' structures and installations from the District's property.
- B. Return exterior areas utilized for temporary facilities to their original, natural state or, when called for on the Contract Documents, complete such areas as indicated.

END OF SECTION 01 52 00

SECTION 01 57 00

TEMPORARY CONTROLS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Traffic plan and controls.
- B. Construction operations under traffic.
- C. Portable changeable message sign.
- D. Pollution abatement.
- E. Erosion and sediment control.
- F. Dust control.
- G. Mud control.
- H. Noise control.

1.02 MEASUREMENT AND PAYMENT

A. Measurement:

- 1. Traffic maintenance and control will be measured for payment as a lump-sum unit, and will include only the items specified herein under Articles 1.04, 1.05, and 1.06.
- 2. All other items of temporary controls will not be measured for payment, but will be considered incidental to the Work of this Contract.

B. Payment:

- 1. Traffic maintenance and control will be paid for at the Contract lump-sum price as designated in the Bid Schedule of the Bid Form.
- 2. All other items of temporary controls will not be paid for separately but will be considered incidental to the Work.

1.03 REFERENCES

A. State of California, Department of Transportation (Caltrans), Standard Specifications:

- 1. Section 12 Construction Area Traffic Control Devices
- 2. Section 82 Markers and Delineators

- B. State of California, Department of Transportation (Caltrans), California Manual of Uniform Traffic Control Devices (California MUTCD), Part 1, Temporary Traffic Control.
- C. State of California, Vehicle Code.
- D. American National Standards Institute (ANSI) S1.4: Specification for Sound Level Meters.

1.04 TRAFFIC PLAN AND CONTROLS

A. Traffic Plan and Permits:

1. The Contractor shall prepare a traffic plan required for the Work. The traffic plan shall include drawings showing proposed traffic control devices including temporary signage and temporary pavement markings and striping. The Contractor shall apply to the jurisdictional agency for approval of the plan and for a permit or permits to work in the public right-of-way.
2. Include traffic plans for each phase of the work requiring different traffic diversion patterns and methods of control. Include for each phase detailed schedules for performance of work and include proposed traffic control devices.

B. Control Devices and Facilities:

1. Furnish, install, operate, maintain, and remove when no longer required, all traffic control and protective devices required for the approved traffic plan.
2. Traffic control and protective devices shall include temporary directional electrical warning signs, detour signs, and danger signals; temporary barricades and guard rails; crash cushions; temporary lighting, overhead warning lights and flashing lights; temporary pavement markings, and removal of permanent and temporary pavement markings; and the services of qualified flaggers.
3. Maintain communication with the jurisdictional agency(s) regarding the Contractor's operations in maintaining and controlling traffic.

C. Traffic Control Signs: Each change in location of traffic shall be adequately posted with signs mounted on barricades or standard posts in accordance with requirements of Caltrans Standard Specifications, Section 12. Temporary "No Parking" signs that are to be used for short periods will be provided by local authorities. The Contractor shall make arrangements for providing temporary no parking signs.

D. Pavement Marking: Install necessary temporary and permanent pavement marking as required in connection with the temporary street work and remove or obliterate existing or temporary pavement markings whenever vehicle traffic is moved to a newly available pavement area or to different traffic patterns. Refer to Section 32 17 23 - Pavement Markings, for requirements.

TEMPORARY CONTROLS

- E. Prior to starting work on each phase requiring traffic control, demonstrate to the satisfaction of the Engineer that necessary materials, equipment, and personnel are on site and that, once started, work can be completed in an expeditious manner without interruptions.
- F. Redirecting Traffic:
1. All channelizing, shifting of traffic lanes, and barricading of traffic in connection with the Work will be subject to approval of the appropriate jurisdictional agency. Existing local standards for signing and marking of construction areas will apply in addition to the requirements of Caltrans Standard Specifications, Section 12.
 2. When required by the Contract Specifications, or indicated on the Contract Drawings, or required by responsible public agencies, the Contractor shall construct, maintain, and remove detours and detour bridges for the use of public traffic.
 3. Failure or refusal of the Contractor to construct and maintain detours at the proper time shall be sufficient cause for closing down the Work until such detours are in satisfactory condition for use by public traffic.
- G. Temporary Closing to Traffic: Prior to temporary closing to traffic of any street, sidewalk, or other access, or to changing traffic patterns from those indicated on the Contract Drawings, obtain approval from appropriate jurisdictional authority, and comply with imposed conditions, at least two weeks before such closures or changes are made. Deviations will be for an emergency condition affecting life and property only, and the Contractor shall immediately notify the Engineer and the appropriate jurisdictional authority of any such emergency changes. Copies of all approvals shall be furnished to the Engineer.
- H. Temporary Walkways: In areas where removal of existing sidewalks is necessary, access to adjacent businesses, entrances, and properties shall be maintained by temporary walkways having a width of not less than 4 feet.
- I. Intersections and Street Crossings: Intersections and street crossings shall be excavated and decked in stages as indicated. Construction shall be phased so that the required number of traffic lanes on each street will be provided at all times during these operations. Upon completion of decking installation, traffic in all directions shall be fully maintained. Trenches or open excavations shall be properly bridged where traffic lanes are to be open to traffic.
- J. Temporary Paving and Patching: Construct, maintain, and remove temporary pavement and patching required to safely and expeditiously handle vehicle and pedestrian traffic, within or adjacent to the jobsite. Temporary pavement and patching composition shall conform to the specifications of the local jurisdictional authority. Any construction, maintenance, or removal required by the Contractor's operations off site shall conform to the requirements specified herein.
- K. New and Existing Traffic Control Devices:
1. The Contractor shall arrange with the respective county and municipal authorities to provide governmental services as required for salvaging reusable street-name and

traffic signs, removal of parking meters, and for removal, relocation, and adjustment of traffic signals.

2. The Contractor shall provide such work and construction services as may be required by county and municipal authorities to assist in salvaging reusable street-name and traffic signs, removing of parking meter posts and bases, and removing, relocating, and adjusting of traffic signals, all in accordance with jurisdictional standards and regulations.

1.05 CONSTRUCTION OPERATIONS UNDER TRAFFIC

- A. Definitions: “Construction equipment” is defined for the purposes of this Article as all types of equipment, vehicles, and tools used in connection with construction work. The term “workers” includes every person or firm performing work in or adjacent to public streets.
- B. Construction Equipment: When in traffic lanes, all vehicles and equipment shall be operated at normal traffic speeds. If this is not practicable, a slow moving vehicle emblem shall be displayed in accordance with the California Vehicle Code. Construction equipment shall not be parked in any lane intended for use by normal traffic. Equipment parked or stored at the work site shall be behind a guard rail, barrier, curb, or other protective device.
- C. One-Way Traffic: No construction equipment shall be operated in traffic lanes, except in the designated direction of travel for respective lanes.
- D. Construction Operations:
 1. Schedule surface operations so that work is not carried on intermittently throughout the area. Excavation or construction activities shall be scheduled and pursued to completion as required to permit opening of street areas to traffic without unnecessary delays.
 2. No construction work involving occupancy of traffic lanes shall be performed during adverse weather conditions or adverse road conditions, and traffic shall be properly safeguarded by the use of flashers and lights in addition to the signs and other markings specified herein. During these periods, no construction deliveries shall take place over a travel lane or immediately adjacent thereto.
 3. When traffic conditions dictate, the Contractor shall modify its work operation for such length of time as required to alleviate the hazardous traffic conditions.
- E. Equipment Travel:
 1. No construction equipment other than that designated and used for general highway transportation shall be moved on streets during hours of darkness or periods of adverse weather conditions that reduce normal visibility.
 2. Any construction equipment or material required for construction operations which exceeds the maximum vehicle dimensions specified in the Motor Vehicle Code, shall be moved only in accordance with established State and local regulations. No such

oversize load shall be moved over public streets without first obtaining approval of the appropriate jurisdictional authority.

- F. Crossing Traffic Lanes: Construction equipment entering the traveled way from the median shall be safeguarded by a portable changeable message sign and with flaggers as required. Where traffic speeds are high, slow-moving construction equipment entering the traveled way shall be protected by a "rolling barricade" supplied by the California Highway Patrol (CHP). This operation shall be performed at off-peak hours, and requires coordination between the Contractor and the CHP, with the cost being borne by the Contractor.
- G. Flaggers: When flagging is required, provide qualified flaggers and flagging in accordance with the requirements of the California MUTCD, Part 6.
- H. Removal of Traffic Control Devices: All temporary signs, barricades, barrier curbs, crash cushions, drums, and cones used to safeguard traffic in connection with construction work shall be removed at the close of the work day, unless the state of the work is such that warning devices are still needed and are adapted for night closing.
- I. Storage: No material or traffic control devices shall be stored on any lane intended for traffic use.

1.06 PORTABLE CHANGEABLE MESSAGE SIGN (CMS)

- A. When conditions warrant, portable changeable message signs shall be furnished, placed, operated, and maintained at locations indicated or designated by the Engineer, in accordance with Section 12-3.01. "General," of the Caltrans Standard Specifications.
- B. A CMS shall be placed at a location 800 to 1000 feet upstream from the beginning of temporary barriers alerting motorists of slow trucks ingressing or egressing the median.
- C. The message shall read: "CAUTION - SLOW TRUCKS AHEAD," unless other words are required by the Engineer.
- D. The CMS shall be in continuous operation during the hours when trucks are entering or leaving the median at a rate greater than two trucks per hour.
- E. When two trucks or less per hour are leaving the median, the CMS shall be in operation only during the time when trucks are entering the traveled way. The CMS shall be turned off after the truck has safely entered the traveled way.
- F. Each portable changeable message sign unit shall consist of a 3-line matrix sign panel, a controller unit, a power supply, and a structural support system all mounted on a trailer. The unit shall be assembled to form a complete self-contained portable changeable message sign that can be delivered to the site of the work and placed in immediate operation. The complete message sign unit shall be capable of operating in an ambient air temperature range of minus 20 degrees C to plus 70 degrees C and shall not be affected by mobile radio transmissions.
- G. The trailer shall be equipped with at least 3 adjustable outrigger leveling pads near the frame corners to permit stable job site installations. The unit shall be capable of resisting

overturning under wind loads of 60 mph with the sign in the fully elevated position. The overall width of the trailer unit, including the sign and mounting brackets, shall not exceed 102 inches while being towed.

- H. The message displayed on the sign shall be visible from 1200 feet and shall be legible from a distance of 750 feet, at noon on a cloudless day, by persons with vision corrected to 20/20. The sign shall be capable of displaying a minimum of 8 characters per line on each of three lines.
- I. The sign face shall be flat black and shall be protected from sun-glare by a method that does not interfere with the clarity of the sign message. The sign shall be raised and lowered by means of a power-driven lifting mechanism.
- J. The matrix sign shall be capable of a complete alphanumeric selection.
- K. Lamp matrix type signs shall be equipped with an automatic dimming operational mode which automatically compensates for the influence of a temporary light source or other abnormal lighting conditions. The sign shall have manual dimming operation modes of three or more different lamp intensities.
- L. Non-lamp matrix signs shall be internally illuminated at night.
- M. The controller shall be an all solid-state unit containing all the necessary circuitry for the storage of at least five pre-programmed messages. The controller shall be installed in a location allowing the operator to perform all functions from one position. A keyboard entry system shall be provided to allow an operator to generate an infinite number of additional messages over the preprogrammed five. The keyboard shall be equipped with a security lockout feature to prevent unauthorized use of the controller.
- N. The controller shall contain a non-volatile memory to hold the keyboard created messages in memory during a non-power period. It shall allow for a variable message display rate that allows the operator to match the information display to the speed of the approaching motorists. The flashing off time shall be operator adjustable within the control cabinet.
- O. Full operation height shall be with the bottom of the sign at least 7 feet above the ground and the top no more than 14 feet, 6 inches above the ground.
- P. The portable changeable message signs, when no longer required for the work, shall become the property of the Contractor.

1.07 POLLUTION ABATEMENT - GENERAL REQUIREMENTS

- A. Comply with General Conditions Article GC7.10. Conduct construction operations in a manner that will minimize pollution of the environment surrounding the area of the Work by all practicable means and methods. Apply specific controls as specified in the Contract Specifications and as follows:
 - 1. Waste Materials: No waste or eroded materials shall be allowed to enter natural or man-made water or sewage removal systems. Eroded materials from excavations, borrow areas, or stockpiled fill shall be contained within the Work area. The

TEMPORARY CONTROLS

Contractor shall develop methods for control of erosion as specified in Article 1.08 herein.

2. Burning: No burning of waste materials or debris will be permitted.
3. Burying: No burying of waste materials and debris will be permitted within the limits of the District's property.

- B. Provide for and maintain the flow of all sewers, drains, building or inlet connections, and all water courses which may be encountered during progress of the Work. Do not allow the contents of any sewer, drain, or building or inlet connection to flow into trenches. Immediately remove from proximity of the Work all offensive matter, using such precautions as are required by local authorities having jurisdiction.

1.08 EROSION AND SEDIMENT CONTROL

- A. Requirements:

1. The Contractor shall prevent erosion of excavated areas, embankments, stockpiled earth materials, and other erodible areas, and shall provide control of runoff sediment from siltation and pollution of the drainage systems.
2. Prevent erosion of excavated areas, embankments, stockpiled earth materials, and other erodible construction areas, and prevent pollution of drainage systems by diversion of storm runoff around construction activities or by trapping or retaining sediment delivered by storm runoff.
3. Provide control of construction operations so that excessive sediment or siltation shall not be introduced into the drainage systems from storm runoff.
4. Comply with all applicable Federal, State, and local laws, orders, and regulations concerning the prevention, control, and abatement of water pollution.

- B. Erosion and Sediment Control Plan:

1. Within 30 calendar days after the effective date of the Notice to Proceed, submit a plan or program for erosion and sediment control for approval.
2. The proposed plan or program shall indicate complete design and construction details and locations of all proposed temporary control structures, barriers, berms, sediment retention basins, and any other salient features.
3. Approval of the Contractor's proposed plan or program shall not relieve the Contractor of responsibility for designing, constructing, operating, and maintaining erosion and sediment control facilities in a safe and systematic manner, and for repairing any damage to the control structures and equipment caused by floods or excessive storm runoff or other unforeseen circumstance.

TEMPORARY CONTROLS

C. Prevention of Erosion:

1. Protect open excavations, trenches, embankments, and the like with barriers, berms, dams, waterproof coverings, or other measures as required to prevent erosion of open earth areas and excavated piles from storm runoff.
2. Protect stockpiled earth materials to prevent erosion.
3. Where natural drainageways are intercepted by construction activities, such drainageways shall be protected so that runoff from the site or water from construction activities is not allowed to enter the natural drainage way.

D. Sediment Control:

1. Sediment retention basins shall be constructed only when there are no other, more economical, measures that can be employed to prevent sediment from entering streams, drainage systems, and storm sewers during storm runoff.
2. Sediment control shall be achieved by well-planned and scheduled excavation and backfill operations and effective control measures.

E. Removal of Temporary Structures: Erosion and sediment control structures and facilities shall be removed from the site upon completion of the affected work.

1.09 DUST CONTROL

- A. The Contractor shall provide dust control at all times, including holidays and weekends, as required to abate dust nuisance on and about the site which is a result of construction activities. Dust control shall be by means of sprinklered water or by other approved methods, except that chemicals, oil, or similar palliative shall not be used.
- B. Quantities and equipment for dust control shall be sufficient to effectively prevent dust nuisance on and about the jobsite; and when weather conditions warrant, sprinklering equipment shall be on hand at all times for immediate availability.
- C. The Engineer shall have authority to order dust control work whenever conditions warrant, and there shall be no additional cost to the District therefor. Dust control shall be effectively maintained whether or not the Engineer orders such work.
- D. Complaints from the public shall be reported to the Engineer and shall be acted on immediately.
- E. Where earthwork operations are in progress, keep exposed earth surfaces dampened continuously. Also, keep dirt accessways and roads dampened continuously.
- F. If portions of the site are temporarily inactive or abandoned for whatever reason, provide dust control and abatement continuously during such periods of inactivity.

- G. Where dust resulting from construction activities has collected on public sidewalks and streets, hose down such sidewalks and streets to abate flying dust particles. Clean all sidewalks and streets from accumulated dirt and dust.

1.10 MUD CONTROL

- A. The Contractor shall take proper measures to prevent tracking of mud onto public streets, drives, and sidewalks. Such measures shall include, but are not limited to, covering muddy areas on the site with clean, dry sand.
- B. All egress from the site shall be maintained in a dry condition, and any mud tracked onto streets, sidewalks, or drives shall be immediately removed, and the affected area shall be cleaned. The Engineer may order such work at any time the conditions warrant.
- C. Where trucks will leave a muddy site and enter paved public streets, the Contractor shall maintain a suitable truck wheel-washing facility and crew. All trucks, or other vehicles leaving the site, shall be cleaned of mud and dirt, including mud and dirt clinging to exterior body surfaces of vehicles.
- D. All trucks coming to the jobsite or leaving the jobsite with materials or loose debris shall be loaded in a manner that will prevent dropping of materials or debris on streets. Spillage resulting from hauling operations along or across any public traveled way shall be removed immediately.

1.11 NOISE CONTROL

- A. Requirements: Minimize noise caused by construction operations, and provide working machinery and equipment fitted with efficient noise suppression devices. Employ other noise abatement measures as necessary for protection of employees and the public. In addition, restrict working hours and schedule operations in a manner that will minimize, to the greatest extent feasible, disturbance to residents in the vicinity of the Work.
- B. Definitions:
 - 1. Daytime refers to the period from 7:00 a.m. to 7:00 p.m. local time daily except Sundays and legal holidays.
 - 2. Nighttime refers to all other times including all day Sunday and legal holidays.
 - 3. Construction Limits are defined for the purpose of these noise control requirements as the District right-of-way lines, construction easement boundaries, or property lines as shown on the Contract Drawings.
 - 4. Zones, Special Zones, and Special Construction Sites outside of the Construction Limits shall be as designated by the local authority having jurisdiction. Such specially designated zones shall be treated by the Contractor as if they were within the Construction Limits.

C. Monitoring:

1. Monitor noise levels of work operations to assure compliance with the noise limitations specified herein. Retain record of noise measurements for inspection by the Engineer.
2. Promptly inform the Engineer of any complaints received from the public regarding noise. Describe the action proposed and the schedule for implementation, and subsequently inform the Engineer of the results of the action.
3. Monitor noise levels day and night and for each new activity or piece of equipment. Start by measuring 3 times a day plus once a night for three consecutive days. Monitor noise levels at least once a week thereafter.

D. Measurement Procedure:

1. Except where otherwise indicated, perform all noise measurements using the A-weight network and "slow" response of an instrument complying with the criteria for a Type 2 General Purpose sound level meter as described in ANSI S1.4.
2. Measure impulsive or impact noises with an impulse sound level meter complying with the criteria of IEC 179 for impulse sound level meters. As an alternative procedure, a Type 2 General Purpose sound level meter on C-weighting and "fast" response may be used to estimate peak values of impulsive or impact noises. Transient meter indications of 125 dB_C "fast" or higher will be considered as indications of impulsive noise levels of 140 d or greater.
3. Measure noise levels at buildings affected acoustically by the Contractor's operations at points between 3 feet and 6 feet from the building face to minimize the effect of reflections.
4. Measure noise levels at points on the outer boundaries of Construction Limits or Special Construction Sites for noise emanating from within.
5. Where more than one criterion of noise limits is applicable, use the more restrictive requirement for determining compliance.

TEMPORARY CONTROLS

E. Continuous Construction Noise: Prevent noise from stationary sources, parked mobile sources, or any source or combination of sources producing repetitive or long-term noise lasting more than a few hours from exceeding the following limits:

1. Maximum Allowable Continuous Noise Level, dBA:

<u>Affected Residential Area</u>	<u>Daytime</u>	<u>Nighttime</u>
Single family residence	60	50
Along an arterial or in multi-family residential areas, including hospitals	65	55
In semi-residential/commercial areas, including hotels	70	60
<u>Affected Commercial Area</u>	<u>At All Times</u>	
In semi-residential/commercial areas, including schools	65	
In commercial areas with no nighttime residency	70	
<u>Affected Industrial Area</u>		
All locations	80	

F. Intermittent Construction Noise: Prevent noises from non-stationary mobile equipment operated by a driver or from any source of non-scheduled, intermittent, non-repetitive, short-term noises not lasting more than a few hours from exceeding the following limits:

1. Maximum Allowable Intermittent Noise Level, dBA:

<u>Affected Residential Area</u>	<u>Daytime</u>	<u>Nighttime</u>
Single family residence areas	75	60
Along an arterial or in multi-family residential areas, including hospitals	75	65
In semi-residential/commercial areas, including hotels	80	70
<u>Affected Commercial Area</u>	<u>At All Times</u>	
In semi-residential/commercial areas, including schools	80	
In commercial areas with no nighttime residency	85	
<u>Affected Industrial Area</u>		
All locations	90	

END OF SECTION 01 57 00

BART Facilities Standards (BFS)

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SECTION 01 58 00

PROJECT IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Project identification signs.
- B. General construction signs.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 PROJECT IDENTIFICATION SIGNS

- A. Requirements: Provide temporary project identification signs as indicated.
- B. Location: Locate the signs as indicated or as designated by the Engineer. Additional identical signs, as desired and paid for by the Contractor, may be placed at intermediate points if first approved by the Engineer. Place no other signs on the right-of-way or within the limits of the jobsite.

1.04 GENERAL CONSTRUCTION SIGNS

- A. Requirements: Provide temporary general construction signs and field office identification signs as indicated or required. Provide field office identification signs for both the Engineer's field office and the Contractor's field office.
- B. Design, Layout, and Size: Design, layout, style of lettering, and colors shall be as shown on the Contract Drawings.
 - 1. General construction signs shall be constructed from a sheet of plywood 4 feet by 8 feet or 3 feet by 6 feet in size, as appropriate for the location, mounted on two posts set in the ground.
 - 2. Field office signs shall be of similar design, 3 feet by 6 feet in size, for wall or post mounting, as appropriate for the location.
- C. Location: Locate the signs as indicated or as designated by the Engineer.

1.05 CONSTRUCTION AND INSTALLATION

- A. Materials: Sign faces shall be constructed of 3/4-inch thick, 5-ply, exterior grade, A-B-faced, Douglas-fir plywood, APA-grade-stamped. The frame shall be nominal 2-by-2 or 2-by-4 stock, either construction-grade Douglas fir or A-grade redwood. Posts shall be 4-by-6 construction-grade Douglas fir, pressure-preservative-treated, 8 to 12 feet long as required for the location.

PROJECT IDENTIFICATION

- B. Construction: Plywood signs shall be let into the frame, and the frame corners shall be mitered and screwed together. The sign shall be screwed to two, 2-by-6 Douglas-fir cleats that shall be bolted to the posts with at least two 1/4-inch bolts per post.
- C. Installation: Sign posts shall be installed in the ground 3 feet deep, with the top of the sign horizontal, level, and even with the top of the posts, 7 feet minimum above the ground.
- D. Painting: Signs shall receive one coat of primer sealer and two base coats of exterior semi-gloss enamel. Generally, letters and logos shall be painted black or BART blue on a white background. Style of letters shall be Helvetica, unless otherwise indicated.
- E. Maintenance: Keep signs clean and in good repair until Substantial Completion of the Contract.
- F. Sign Quantities: Quantities of signs required are shown on the Contract Drawings.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 CLOSEOUT

- A. Upon completion of the Work, the signs shall be left in place or shall be removed and disposed of off the District's property, as determined by the Engineer.

END OF SECTION 01 58 00

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Quality of materials.
- B. VOC regulations.
- C. Appurtenances and accessories.
- D. Packaging and handling.
- E. Transportation and delivery.
- F. Storage and protection.
- G. Material safety data sheets.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 QUALITY OF MATERIALS

- A. Materials, equipment, appliances, fixtures, and fabricated assemblies to be incorporated in the Work shall be new, except as may be indicated or specified otherwise in the Contract Documents.
- B. Materials, equipment, assemblies, and systems shall be manufactured, fabricated, handled, and incorporated into the Work so as to ensure completed work meeting the Contract requirements.
- C. Additional quality assurance provisions for materials and equipment are specified in Section 01 43 00 - Quality Assurance.
- D. Additional Requirements are included in General Conditions Article GC6, Control of Materials.

1.04 VOC REGULATIONS

- A. Materials shall comply with the current, applicable regulations of the Environmental Protection Agency (EPA), California Air Resources Board (CARB), and the Bay Area Air Quality Management District governing permissible content of volatile organic compounds (VOC).

1.05 APPURTENANCES AND ACCESSORIES

- A. Products to be incorporated in the Work shall be furnished as complete assemblies or systems with all appurtenances and installation anchors, fasteners, and accessories as required to provide a complete and finished product installation.
- B. Installed products with moving parts shall be fully operable at proper settings and levels in accordance with the respective manufacturers' instructions and recommendations.

1.06 PACKAGING AND HANDLING

- A. Avoid bending, scraping, or overstressing materials and equipment. Protect projecting parts by blocking with wood, by providing bracing, or by other approved methods.
- B. Materials and equipment shall be protected from soiling and moisture by wrapping or by other approved methods.
- C. Small parts shall be packaged in containers such as boxes, crates, or barrels to avoid dispersal and loss. Firmly secure an itemized list and description of contents to each such container.

1.07 TRANSPORTATION AND DELIVERY

- A. Arrange deliveries of materials and equipment in accordance with the Detailed Project Schedule specified in Section 01 32 16 - Construction Progress Schedule, and coordinate to avoid conflict with work and conditions at the site.
- B. Deliver materials in undamaged condition, in manufacturers' original containers or packaging (where applicable), with identifying labels intact and legible.
- C. Deliver cement, prepared dry mortar mixes, grouting material, plaster, and coloring material in original, unopened and sealed containers, bearing the brand and manufacturer's name.
- D. Refer also to the individual Specifications Sections for detailed requirements as applicable.

1.08 STORAGE AND PROTECTION

- A. The receiving, storage, quality, and inventory control of equipment and materials required for the Work of this Contract shall be the sole responsibility of the Contractor. Arrange storage to provide easy access for inspection and identification of each shipment.
- B. Store materials in such a manner as to ensure the preservation of their quality and fitness for the work and to facilitate inspection.
- C. Provide sheltered, weathertight, or heated weathertight storage as required to protect materials and equipment from weather damage and corrosion.
- D. Store manufactured materials in accordance with the various manufacturers' instructions, with seals and labels intact and legible. Maintain temperature and humidity within the ranges required by the various manufacturers' instructions.

PRODUCT REQUIREMENTS

- E. Provide blocking, platforms, pallets, or skids for materials and equipment subject to damage by contact with earth or pavement. Provide clearances from adjacent surfaces for stored materials requiring natural ventilation.
- F. Store packaged materials in their original unbroken packages or containers.
- G. Protect materials and equipment from damage and corrosion during warehousing operations.
- H. Perform periodic inspections of stored materials to assure that materials are maintained under specified conditions, and are free from damage or deterioration.
- I. Continue protection of materials and equipment from damage and corrosion after installation until final acceptance of the Work.
- J. Refer also to the individual Specifications Sections for detailed requirements, as applicable.

1.09 MATERIAL SAFETY DATA SHEETS (MSDS)

- A. The Contractor shall furnish MSDS for all materials to be incorporated in the Work. A file drawer or drawers shall be provided in the Contractor's field office (or other acceptable location) for the filing of all MSDS. MSDS shall be filed in accordance with Specifications' Section numbers, and shall be readily available to the Engineer, jurisdictional inspection authorities, and all personnel engaged in the Work.
- B. MSDS for material that are flammable or otherwise hazardous shall be posted on a bulletin board provided for this specific purpose. This bulletin board shall be located at the site, sheltered from rain and wind, and shall be readily accessible to all personnel engaged in the Work.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 60 00

BART Facilities Standards (BFS)

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SECTION 01 64 13

DISTRICT- FURNISHED MATERIALS (DFM) AND DISTRICT-FURNISHED EQUIPMENT (DFE)

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. District-furnished materials and District-furnished equipment.
- B. Delivery, storage and handling.
- C. Installation facilities, tools and materials.
- D. Installation instructions and supervision

1.02 RELATED SECTIONS AND DOCUMENTS

- A. Refer to Section 01 60 00 - Product Requirements, for handling, storage, and other pertinent requirements.
- B. General Conditions Article GC6.2 District-Furnished Materials (DFM) and District-Furnished Equipment (DFE).

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Installation of District-furnished materials and District-furnished equipment will be measured for payment as a lump-sum unit, acceptably stored and installed.
- B. Payment: Installation of District-furnished materials and District-furnished equipment will be paid for at the Contract lump-sum price indicated in the Bid Schedule of the Bid Form.

1.04 ABBREVIATIONS

- A. District-furnished materials may be referred to herein and in other Sections of the Specifications, where applicable, by the abbreviation DFM.
- B. District-furnished equipment may be referred to herein and in other Sections of the Specifications, where applicable, by the abbreviation DFE.

1.05 DISTRICT-FURNISHED MATERIALS AND DISTRICT-FURNISHED EQUIPMENT

- A. The materials and equipment to be furnished by the District for installation by the Contractor are specified in the Contract Specifications, Section 01 64 13 - District-Furnished Materials (DFM) and District-Furnished Equipment (DFE).

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Requirements: The Contractor shall assume custody of, and provide protection for, all District-furnished materials and District-furnished equipment from delivery and acceptance by the

Contractor until Substantial Completion of the Work and the return of any excess materials and equipment.

- B. Protection: Protect all District-furnished materials and District-furnished equipment while in custody from theft, vandalism, loss, and damage during unloading, storing, handling, distributing, and installing the materials and equipment. Lost or damaged materials and equipment, as documented by the District, shall be replaced by the Contractor at no additional cost to the District.
- C. Delivery Schedule:
 - 1. District-furnished materials and District-furnished equipment will be delivered by the respective suppliers to the delivery sites indicated, within the dates indicated in the listing in the Contract Specifications, Section 01 64 13 - District-Furnished Materials (DFM) and District-furnished Equipment (DFE). District-furnished materials and District-furnished equipment will be delivered to the delivery sites between the hours of 7:00 a.m. and noon, Monday through Friday.
 - 2. The method and rate of material delivery will be determined by the respective suppliers, and this information will be reported by the District to the Contractor at least two weeks prior to the initial delivery of each type of material.
 - 3. All Contractor requests for modification to the delivery method, location, rate, or date(s) shall be made through the Engineer. Should an agreement be reached to modify any delivery parameter, all additional costs due to the modification shall be paid by the Contractor.
- D. Unloading: The Contractor shall provide all labor, equipment, and materials necessary to unload, handle, stockpile, and store District-furnished materials and District-furnished equipment. The Contractor shall unload and stockpile or store all District-furnished materials and District-furnished equipment within 4 hours of their arrival at the delivery site. Unloading and handling shall be in accordance with the respective manufacturer's recommendations as furnished by the Engineer.
- E. Storage Plan: Prepare a storage plan for each storage area where District-furnished materials and District-furnished equipment are proposed to be stored or stockpiled. The plan shall be in sufficient detail to demonstrate that efficient handling and security provisions have been provided, that supporting soils will not be overloaded, and that materials will not be overstressed due to bending or shear. A running inventory of the materials on hand shall be provided and kept, and the Contractor shall notify the Engineer at least 30 days in advance of any anticipated shortages.
- F. DFM and DFE Acceptance: Inspect all District-furnished materials and District-furnished equipment at time of delivery by the respective suppliers to the delivery sites, and submit certification to the Engineer showing the quantity of accepted materials and equipment. Set aside all damaged materials and equipment, and immediately notify the Engineer and the delivery carrier in writing of the damage and circumstances of discovery.
- G. Inventory Records: Prepare and maintain perpetual inventory records of District-furnished materials and District-furnished equipment, and assign stock number, date of receipt from the

District, and approximate date of construction placement. All checkout and returns of District-furnished materials and District-furnished equipment or other transfer of materials and equipment between the Contractor and the District shall be accompanied by an inventory record form.

- H. Excess Materials: Upon Substantial Completion of the Work, the Contractor shall transport, unload, and stockpile, all excess District-furnished materials and District-furnished equipment to a delivery location within a 50 mile radius of the jobsite, as determined by the Engineer.

1.07 INSTALLATION FACILITIES, TOOLS, AND MATERIALS

- A. The Contractor shall furnish all facilities, tools, equipment, materials, and services needed to complete the installation of District-furnished materials and District-furnished equipment, and such other tools, equipment, materials, and services as required to complete the Work.
- B. District-furnished materials and District-furnished equipment shall be installed accurately and efficiently to avoid waste, such as that due to incorrect or inaccurate installations. Wasted materials and equipment, as documented by the Engineer, shall be replaced by the Contractor at no additional cost to the District.

1.08 INSTALLATION INSTRUCTIONS AND SUPERVISION

- A. The Engineer will provide the Contractor with installation instructions and drawings from the manufacturers of District-furnished equipment. In addition, the assembly, installation, and testing of the major and more complex items of mechanical equipment, electrical and electronic equipment, and communications and radio equipment shall be performed under the technical supervision of installation supervisors from the various manufacturers' organizations.
- B. Installation supervisors' services for District-furnished equipment will be obtained by and at the expense of the District, and the installation supervisor will be made available, insofar as possible, when needed by the Contractor.
- C. The Contractor shall be responsible for coordinating the work and cooperating with the Engineer in scheduling the time when each installation supervisor will be needed in order to best conform with the installation and testing schedules and still allow sufficient advance notice to the manufacturer for scheduling the most suitable installation supervisor.
- D. The Contractor shall be responsible for any work performed in the absence of the installation supervisor, or work that does not conform to such supervisor's instructions, and any resulting errors in assembly or installation shall be corrected by the Contractor without additional cost to the District.
- E. The Contractor will not be held responsible for faulty manufacture of the equipment, for any errors in the manufacturers' assembly drawings, or for erroneous instructions issued by the installation supervisor.

PART 2 – PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 64 13

SECTION 01 71 13

MOBILIZATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Organization and mobilization of the Contractor's forces.
- B. Transporting construction plant and equipment to the jobsite and setting up of same.
- C. Transporting various tools, materials, and equipment to the jobsite.
- D. Erection of temporary buildings and facilities as required for field offices, staging, storage, and construction operations.

1.02 RELATED SECTIONS

- A. Refer to Section 01 51 00 - Temporary Utilities, Section 01 52 00 - Construction Facilities, Section 01 57 00 - Temporary Controls, and Section 01 58 00 - Project Identification for specific requirements, as applicable.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: The work of this Section will not be measured separately for payment.
- B. Payment: Mobilization will be paid for at the Contract lump sum price, and will include accumulating tools, apparatus, equipment, materials, and personnel, and performing final removal and demobilization. The Contract lump sum price will be paid as follows:
 - 1. 45 percent of the Contract lump sum price within 30 days of the effective date of the Notice to Proceed.
 - 2. 45 percent of the Contract lump sum price within 60 days of the effective date of the Notice to Proceed.
 - 3. 10 percent of the Contract lump sum price after the Engineer has determined that the Contractor has left the work site in a clean condition after the completion of all phases of work.

1.04 DESCRIPTION

- A. Mobilization shall include mobilization of all construction equipment, materials, supplies, appurtenances, facilities, and the like, staffed and ready for commencing and prosecuting the Work; and the subsequent demobilization and removal from the jobsite of said equipment, appurtenances, facilities, and the like upon completion of the Work.

MOBILIZATION

- B. Mobilization shall also include assembly and delivery to the jobsite of plant, equipment, tools, materials, and supplies necessary for the prosecution of work which are not intended to be incorporated in the Work; the clearing of and preparation of the Contractor's work area; the complete assembly, in working order, of equipment necessary to perform the required work; personnel services preparatory to commencing actual work; and all other preparatory work required to permit commencement of the actual work on construction items for which payment is provided under the Contract.

1.05 SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.
- B. Submit a plan of the proposed layout of the construction site, including fences, roads, parking, buildings, staging, and storage areas, within seven days after the effective date of the Notice to Proceed.

1.06 DELIVERY

- A. Delivery to the jobsite of construction tools, equipment, plant, temporary buildings, materials, and supplies shall be accomplished in conformance with local governing ordinances and regulations.

1.07 TOOLS AND SUPPLIES

- A. Provide construction tools, equipment, materials, and supplies of the types and quantities necessary to facilitate the timely execution of the Work.
- B. Provide personnel, products, construction materials, equipment, tools, and supplies at the jobsite at the time they are scheduled to be installed or utilized.

1.08 PLANT LOCATION

- A. Locate plant, or plants, appropriately close to the portion of the Work for which it will be used.

1.09 DEMOBILIZATION

- A. Upon completion of the Work, remove construction tools, apparatus, equipment mobile units and buildings, unused materials and supplies, plant, and personnel from the jobsite.
- B. Restore all areas utilized for mobilization to their original, natural state or, when called for in the Contract Documents, complete such areas indicated.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 71 13

SECTION 01 71 23

FIELD ENGINEERING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Qualified services.
- B. Lines and grades.
- C. Survey of layout and performance.
- D. Surveying accuracy and tolerances in setting survey stakes.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 REFERENCES

- A. National Oceanic and Atmospheric Administration (NOAA): "Surveying Standards"

1.04 SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.
- B. Survey notes, drawings, and calculations shall be completed as the work progresses and one copy of each survey document shall be submitted to the District for record purposes.
- C. Construction survey notes shall be provided to the Engineer within 48 hours after completion of the Contractor's survey.
- D. Submit maps showing all final centerline, station, and other Contractor-installed monumentation, properly prepared and submitted to the Engineer for approval.

1.05 QUALIFIED SERVICES

- A. Surveying services and field engineering services shall be performed under the direct supervision of a professional land surveyor or civil engineer currently licensed or registered in the State of California. A civil engineer providing field surveying shall have been registered prior to 1982 or have a current professional land surveyors license in the State of California.

1.06 LINES AND GRADES

- A. Only such primary control lines, monuments, and bench marks will be set by the District as the District determines to be necessary to control establishment of the lines and grades required for completion of the Work. In general, these will consist of the primary horizontal and vertical control points indicated on the Contract Drawings. Work points shall be established by the

Contractor for all major structures, all track alignments, and all roadway alignments. Survey monuments shall be set at each end of station platforms by the Contractor to establish platform finish elevations.

- B. Primary control monuments set by the District shall be carefully preserved by the Contractor. In case such monuments are destroyed or damaged, they will be replaced at the District's earliest convenience. The Contractor will be charged for the cost of replacing or restoring monuments destroyed or damaged by the Contractor's operations. This charge will be deducted from any monies due or to become due the Contractor.
- C. The Contractor shall temporarily suspend work at such points and for such reasonable times as the District may require for resetting monuments, and the Contractor will not be entitled to any additional compensation or extension of time therefore.
- D. All other stakes or markers required to establish the lines and grades required for the completion of the Work shall be the responsibility of the Contractor.

1.07 SURVEYS FOR LAYOUT AND PERFORMANCE

- A. **Surveying Requirements:** Perform all surveys for layout and performance of the Work, reduce the field notes, and make all calculations and drawings necessary to carry out such work. The Contractor shall check the relative positions of all monuments and benchmarks to be used and shall report any damaged or out-of-position monuments to the Engineer at once. The Contractor shall check such relative positions each time the Contractor uses such monument or benchmark.
- B. **Datum:** The Contractor shall be responsible for correctly locating all lines and grades and for performing all measuring as required for the construction and completion of the Work from established reference points and information is shown on the Contract Drawings.
- C. **Equipment and Personnel:** The Contractor's instruments and other survey equipment shall be accurate, suitable for the surveys required in accordance with recognized professional standards, and in proper condition and adjustment at all times. Perform all surveys under the direct supervision of a professional land surveyor or civil engineer currently licensed or registered in the State of California.
- D. **Field Notes and Records:** Furnish the original pages of all survey records to the Engineer at intervals required by the Engineer. Furnish each field notebook to the Engineer when filled or completed.
- E. **Use by the Engineer:** The Engineer may at any time use line and grade points and markers established by the Contractor. The Contractor's surveys are a part of the work and may be checked by the Engineer at any time. The Contractor shall be responsible for any lines, grades, or measurements which do not comply with specified or proper tolerances, or which are otherwise defective, and for any resultant defects in the work. The Contractor shall conduct resurveys or check surveys to correct errors indicated by review of the field notebooks or by check surveys performed by the Engineer.

1.08 SURVEYING ACCURACY AND TOLERANCES IN SETTING SURVEY STAKES

- A. Surveying Accuracy: Control traverse field surveys and computations, including surveys of main control lines to determine horizontal and vertical alignment of major structure components, shall meet the accuracy requirements for Second Order, Class I Surveys as specified by the National Oceanic and Atmospheric Administration (NOAA). Staking for construction or equipment installations shall meet the accuracy requirements for Second Order, Class II Surveys as specified by NOAA.

- B. Tolerances: The tolerances generally applicable in setting survey stakes shall be as set forth in Article 1.08.A above. Such tolerances shall not supersede stricter tolerances required by the Contract Drawings or Specifications, and shall not otherwise relieve the Contractor of responsibility for measurements in compliance therewith.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 71 23

BART Facilities Standards (BFS)

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SECTION 01 74 14

CLEANING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Cleaning and cleanup during construction.
- B. Dust control.
- C. Disposal of debris.
- D. Final cleaning of station facilities and ancillary buildings.
- E. Final site cleanup.

1.02 RELATED SECTIONS

- A. Refer to Section 01 57 00 - Temporary Controls, for basic mud control and dust abatement requirements.
- B. When demolition is involved, refer to Section 02 41 19 - Selection Structure Demolition, as applicable, for additional dust abatement requirements.

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 CLEANING AND CLEANUP DURING CONSTRUCTION

- A. The entire site of the Work, including the Contractor's work and storage areas, shall be kept in a neat, clean, and orderly condition at all times during the course of this Contract. The Engineer may, at any time during construction, order a general cleanup of the site as a part of the Work, and there shall be no additional cost to the District therefore. The Contractor shall provide general daily clean-up and disposal service for removal of waste, rubbish, trash, and debris away from the jobsite.
- B. Perform cleaning of all facilities and ancillary buildings as required during construction to prevent accumulations of dust, dirt, soil, trash, and debris, so that a clean and safe working environment will be present at all times.
- C. Walkways or designated pathways for authorized visitors shall be kept broom clean at all times. Walkways over exposed earth surfaces shall also be kept neat and free of pebbles and other obstacles to walking comfortably, equivalent to broom clean of paved surfaces.
- D. The Contractor shall remove all graffiti placed during the course of the Work within the Contractor's enclosed secured areas at the work site. The Contractor shall remove the graffiti within 24 hours after its detection in these areas.

1.05 DUST CONTROL

- A. Clean interior spaces prior to the start of finish painting and the application of other finishes, and continue cleaning as required until such work is completed.
- B. Schedule operations to prevent dust and other contaminants, resulting from cleaning operations, from adhering to set or newly finished surfaces.
- C. Also, schedule operations to prevent dust and other flying particles from contaminating sensitive train control equipment in Train Control Rooms. Enforce tight controls as required to provide absolute dust control and abatement in these areas.

1.06 DISPOSAL OF DEBRIS

- A. Dispose of waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no waste material and debris on the site. Burning of trash and debris on the site will not be permitted.
- B. Location of disposal site for trash and debris and length of haul are the Contractor's responsibility.

1.07 FINAL CLEANING OF STATION FACILITIES AND ANCILLARY BUILDINGS

- A. Prior to final inspection by the District, and after all construction work is essentially complete, thoroughly clean station facilities and ancillary buildings and structures, utilizing professional building cleaners where appropriate.
- B. Items to be cleaned include all glass, doors, hardware, opening frames, grilles, trim, exposed non-ferrous metal surfaces, plastics, floor coverings, light fixtures and plates, plumbing fixtures and trim, and all finish surfaces throughout the construction.
- C. Vacuum-clean where appropriate and remove all spots, smears, dust, debris, hand prints, and defacements of every sort, including those of vandals. Use commercial cleaning compounds where necessary.
- D. Follow the recommendations of the manufacturers of the materials and items to be cleaned for all cleaning, polishing, and treatment such as waxing or sealing. Polish all stainless steel and other non-ferrous metal surfaces.
- E. Clean permanent filters of the air-conditioning system and replace disposable filters of units operated during construction. Clean ducts, blowers, and coils if units were operated without filters during construction.

1.08 FINAL SITE CLEANUP

- A. Prior to Final Inspection, thoroughly clean the entire site and put it into a clean and neat, acceptable condition. Remove from the site all construction waste and unused materials, dunnage, loose rock and stones, excess earth, and debris of any description resulting from the Work.

CLEANING

- B. Hose down and scrub clean where necessary all pavement and paved walks.
- C. Thoroughly remove mortar droppings from concrete slabs and pavement where they occur. Hose down and scrub clean all concrete flatwork and exposed vertical surfaces of concrete and masonry.
- D. Free and clear all new and existing drainage systems.
- E. Clean and protect all conduit openings.
- F. Prior to Final Inspection, the Contractor shall remove all markings from streets, sidewalks, walls and other District and City infrastructure within the enclosed secured area at the work sites.

PART 2 – PRODUCTS

Not Used

PART 1 – EXECUTION

Not Used

END OF SECTION 01 74 14

BART Facilities Standards (BFS)

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SECTION 01 74 21

WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Waste management plan.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related items of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 DEFINITIONS

- A. "Conversion Rate" means the rate set forth in the standardized Conversion Rate Table approved by the Engineer for use in estimating the weight of materials identified in the Waste Management Plan.
- B. "Divert" means to use material for any purpose other than disposal in a landfill or transfer facility.
- C. "Good faith" shall be as defined by law.
- D. "Recycling Service" means an off-site service that provides processing of material and diversion from landfill.
- E. "Hauler" means the entity that transports construction and demolition debris to either a landfill or a recycling service.

1.04 SYSTEM DESCRIPTION

- A. Performance Requirements: The requirements for diversion of construction and demolition debris from landfill shall in no case be less than that required by local regulations. The minimum percentages for diversion of construction and demolition waste shall be as follows, unless modified in Contract Specifications Section 01 74 21 - Waste Management, on the basis of a waste characterization study for the Work:
 1. Divert a minimum of 70 percent of construction waste from landfill.
 2. Divert a minimum of 100 percent of steel and concrete demolition waste from landfill and an overall minimum of 50 percent of remaining demolition waste from landfill.
- B. Specific Requirements: Recycle magnetic ballasts and older fluorescent lamps containing polychlorinated biphenyls (PCBs) and other toxic chemicals in such a manner that potentially dangerous chemicals are safely reprocessed.

1.05 SUBMITTALS

- A. Submit specified Waste Management Plan using written and graphic representation to indicate how waste will be diverted from landfills.
- B. Submit certification from recycling services that are not listed in directories acceptable to the Engineer. Examples of directories acceptable to the Engineer are listed under the Article entitled “Quality Assurance” herein.
- C. Submit reports in accordance with approved Plan.

1.06 QUALITY ASSURANCE

- A. Regulatory requirements
 - 1. Comply with the requirements of the jurisdictional authority. In instances where the requirements specified herein are more stringent than those of specified herein, comply with specified requirements.
 - 2. Obtain approval of the Waste Management Plan by the jurisdictional authority before beginning on-site mobilization if such approval is mandated by the jurisdictional authority.
- B. Recycling service company qualifications; any of the following:
 - 1. Listed in the City of Oakland, “Directory of Recycling Services for Construction and Demolition Material”.
 - 2. Listed in the Alameda County Waste Management Authority’s “Builders’ Guide to Reuse and Recycling, A Directory for Construction and Demolition Materials.
 - 3. Listed in Central Contra Costa Solid Waste Authority’s, “Builder’s Guide”.
 - 4. Any recycling services that will certify in writing that accepted waste will be diverted from landfill, not dumped illegally, and not dumped at sea.

1.07 WASTE MANAGEMENT PLAN

- A. Plan Development: Develop a plan for diverting the specified percentage of construction debris from landfill. Include in plan either or both written and graphic information to indicate how waste will be diverted from landfills.
 - 1. Submit and discuss the plan at or before the pre-construction meeting.
 - 2. Propose means and methods for collecting and separating each type of debris deemed reusable or recyclable.
 - 3. Identify the off-site recycling service and hauler of each designated debris item, who have agreed to accept and divert that item from landfill, in the proposed quantities anticipated. Schedule each item and list off-site recycling service and hauler company name, telephone number, address, and person contacted.

WASTE MANAGEMENT

4. Include a "good faith" estimate of each type of construction waste that would be generated if no diversion methods were implemented. Submit with calculations based upon weight of each material. The following items are subject to the "good faith" estimate and diversion requirement:
 - a. Asphalt concrete
 - b. Portland cement concrete
 - c. Brick, clay products and ceramic tile
 - d. Aggregate
 - e. Clean earth fill
 - f. Metals
 - g. Wood products, including pallets
 - h. Plant and tree trimmings, may be included in wood products if so accepted by recycling service.
 - i. Gypsum board
 - j. Latex paint (not applicable to demolition work)
 - k. Plastic piping
 - l. Glass, excluding that used for containers
 - m. Insulations
 - n. Acoustical ceiling tiles, panels and boards
 - o. Resilient floorings
 - p. Carpets, and polyurethane foam pads (other types of pads may be included if accepted by recycling service)
 - q. Cardboard and paper products
 - r. Other, depending on anticipated waste.
5. Calculate quantities, and convert volume measurements to weights in accordance with the defined Conversion Rate.

B. Plan Implementation

1. Maintain log of each load, of each category item diverted from landfill. Log in separately debris sent to a Class III landfill and materials sent to recycling facilities.

WASTE MANAGEMENT

- a. Include in log, type of load, load weight, name of hauling service; recycling service or landfill, and date accepted by recycling service or by landfill.
 - b. The Engineer reserves the right to audit the log at any time, retain and make available, all weight tickets, copies of receipts and invoices.
 - c. Units of measure: Use same units as stated in the approved plan "good faith" estimate of construction waste that would be generated if no remedial methods were implemented.
2. Material handling
- a. Separation facilities
 - 1) Designate a specific on site area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return.
 - 2) Keep waste bins and pile areas neat and clean. Clearly mark bins for each category of waste. Do not commingle non-recyclable waste with materials designated for reuse or recycling.
 - b. Environmental controls during handling, storage, or transport: Do not permit designated materials to become contaminated or to contaminate site or surrounding areas.
3. Training and coordination
- a. Furnish copies of the Waste Management Plan to all on-site supervisors, each subcontractor, and the Engineer.
 - b. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all entities at the appropriate stages of the Work.
 - c. Meetings: Include construction waste management on the agenda of meetings. At a minimum, discuss waste management goals and issues at the following meetings:
 - 1) Pre-construction meeting.
 - 2) Regularly scheduled job-site meetings.
- C. Hazardous waste: Separate hazardous waste. Store and dispose of according to Contract requirements and local regulations.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 74 21

BART Facilities Standards (BFS)

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SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Requirements preparatory to final inspection.
- B. Final inspection.
- C. Acceptance of the Work and final payment.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 REQUIREMENTS PREPARATORY TO FINAL INSPECTION

- A. The Contractor shall request a preliminary final inspection to determine the state of completion of the Work.
- B. The request shall be made in writing, addressed to the Engineer, at least seven days in advance of the requested date of the preliminary inspection.
- C. The Engineer will perform the preliminary inspection within three days of the requested date.
- D. Prior to the requested date of the preliminary inspection, the Contractor shall perform or provide the following, as applicable:
 - 1. Temporary facilities, except as may be required for punch list work, shall be removed from the site.
 - 2. The site and all applicable appurtenances and improvements shall be cleaned as specified in Section 01 74 14 - Cleaning.
 - 3. Record drawings and specifications shall be completed, signed, and submitted to the Engineer as specified in Section 01 78 39 - Project Record Documents.
 - 4. Operating instructions for equipment shall be properly mounted and posted as specified in Section 01 78 23 - Operation and Maintenance Data.

5. Guaranties and warranties shall be submitted to the Engineer, as specified in the General Conditions and various sections of the Specifications, along with required operations and maintenance manuals as specified in Section 01 78 23 - Operation and Maintenance Data.
- E. The Contractor shall be represented by its principal superintendent and such Subcontractors and Suppliers as may be necessary to answer the questions of the Engineer's inspection team.
- F. Certain elements of the Work, such as mechanical and electrical work, may be scheduled separately at appointed times in order to keep the preliminary inspection more focused and the number of persons in the Engineer's inspection team to a minimum.
- G. From the information gathered from this inspection, the Engineer will prepare a punch list of work to be performed, corrected, or completed.
- H. All work on the punch list shall be completed by the Contractor prior to requesting the final inspection.

1.04 FINAL INSPECTION

- A. When all requirements of the above prepared punch list have been completed, the Contractor shall request the final inspection to determine eligibility for issuance of the Certificate of Substantial Completion.
- B. The request shall be made in writing, addressed to the Engineer, at least seven days in advance of the requested date of the final inspection.
- C. The Contractor shall be represented by its principal superintendent and such Subcontractors and Suppliers as may be necessary to verify the completion of the Work including punch list items.
- D. Depending on the extensiveness of the punch list items, certain elements of the Work may be scheduled separately for final inspection at appointed times.
- E. If the Work has been substantially completed in accordance with the Contract Documents, and only minor corrective measures are required, the Engineer will recommend that the District issue a Certificate of Substantial Completion, based upon the Contractor's assurance that remaining corrective measures will be completed within the shortest practicable time period. The Engineer will attach a corresponding punch list to the Certificate of Substantial Completion. A fixed schedule for such corrective measures shall be submitted to the Engineer, for approval.
- F. If the Work has not been substantially completed in accordance with the Contract Documents, and corrective measures are still required, a new punch list will be prepared

by the Engineer, based on the information gathered from the final inspection, and the Contractor will be required to complete this work and then call for another final inspection, following the procedure outlined above.

- G. The date of the Certificate of Substantial Completion will establish the completion date of the Work, or portions thereof as specifically referenced in the Certificate, for determining liquidated damages.

1.05 ACCEPTANCE OF THE WORK AND FINAL PAYMENT

- A. Upon completion of the Substantial Completion punch list items, the Engineer will recommend that the District formally accept the Work.
- B. Acceptance of the Work will be made in accordance with Article GC5.14 of the General Conditions. Final payment will be made in accordance with Article GC9.8 of the General Conditions.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 77 00

BART Facilities Standards (BFS)

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SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Post operating instructions.
- B. Manual description.
- C. Submittal requirements.
- D. Submittal of final operation and maintenance manuals.
- E. Liquidated damages in regard to O&M manual submittals.
- F. Off-the-shelf equipment manuals.
- G. Native electronic file format for system manuals
- H. Format and technical content for system manuals.
- I. Printed manual requirements.
- J. Electronic version of manual (eManual) for system manuals.
- K. Manual revision control.

1.02 RELATED SECTIONS

- A. Requirements related to spare parts, maintenance materials, keys, special tools, and test equipment are specified in Section 01 78 44 - Spare Parts and Maintenance Materials.
- B. Training manuals required for classroom and on-site instruction and training are specified in Section 01 79 00 - Demonstration and Training.

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 REFERENCES

- A. Air Transport Association of America (ATA):
 - 1. ATA Specification 2200

- B. American National Standards Institute (ANSI)
 - 1. ANSI Y14 - Drafting Standards Manual
 - 2. ANSI Y32.2 - Graphic Symbols for Electrical and Electronics Diagram

1.05 POSTED OPERATING INSTRUCTIONS

- A. Provide, where directed, printed sheets under framed clear acrylic plastic, giving brief, concise operating and maintenance instructions for all items of mechanical and electrical equipment and similar equipment and specialty items, as applicable, at their respective locations.

1.06 MANUAL DESCRIPTION

- A. Manuals shall be provided for all equipment and systems furnished under the Contract that require maintenance, operation, or modification including testing and training equipment. Manuals shall also be provided for other items, such as finishes, when specified in the Contract Specifications. Provide manuals for each item of equipment and its component parts.
- B. Prepare manuals in English.
- C. Manuals will be subject to revisions, updates, and other alternations as determined by the District.
- D. Manuals shall be provided in one of the two following formats:
 - 1. Off-the-Shelf Equipment Manuals shall be provided for off-the-shelf items. Such equipment includes equipment that will be replaced instead of repaired or has no need for modifications, drawings, or manual revisions. Off-the-Shelf Equipment Manuals shall conform to the requirements specified in Articles 1.07, 1.08, and 1.10 herein.
 - a. Manuals for Elevators: Manuals containing manufacturers' operation and maintenance instructions and catalog cuts are acceptable for elevator manuals provided the manuals meet the technical content requirements set forth in Article 1.12 in addition to the requirements specified for Off-the-Shelf Equipment Manuals.
 - 2. System Manuals shall conform to the requirements specified herein. System manuals shall be provided whenever stipulated in the Contract Specifications. Typically, such systems and equipment will include systems and equipment which have been specifically built for the District and which require repairs and modifications beyond the scope of manufacturer's pre-existing operation and maintenance instructions. Systems manuals shall be BART specific and not include copies of manufacturer's operation and maintenance instructions and catalog cuts. Submit manufacturer's operation and maintenance instructions, if required, separately. System Manuals shall conform to the requirements specified herein with the exception of Article 1.10.
- E. Instructions and manuals from suppliers of District-furnished equipment will be furnished to the Contractor.

- F. The District will provide electronic versions of Specification Sections to the Contractor upon request.

1.07 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements. Schedule submittal of manuals in coordination with other submittals for the subject system or equipment.
- B. Submit 6 sets of hard copy originals for review of each draft manual and for District's use of each final approval manual. For System Manuals, concurrently submit electronic media samples in native electronic file format with submittal of each draft and final approved manual with the exception of the Outline.
- C. System manuals shall be submitted in accordance with the following requirements:
1. Submit Outline, Complete Draft, and Pre-Final submittals for review before submitting final version.
 - a. Outline – Submit manual layout, sections and headings after final design of system or equipment has been approved.
 - b. Complete Draft – Submit all text and illustrations. Sample of binder and electronic files prior to first delivery of system or equipment.
 - c. Pre-Final – Submit complete manual in accordance with criteria specified herein.
 2. Pre-Final O&M Manual Review: Submit for approval prior to Acceptance Tests for the particular system or equipment and no later than 30 days prior to initial training course for BART personnel.
 - a. Information gathered during Acceptance Testing and training courses shall be used to develop final draft version of the manual.
- D. Submission of each manual (except for off-the-shelf equipment manual) in its final form shall include two CD-ROMs of the electronic version (eManual) along with all native electronic files required to create the submitted manual. Electronic files shall include a matrix or document showing how the files are set up and how to access them. Include no extraneous files.
- E. Off-The-Shelf Equipment Manuals:
1. Submit draft manual for review prior to initial delivery of particular equipment.
 2. For elevator manuals prior to submittal of draft manual, submit and obtain approval of the proposed Table of Contents including chapter numbers and titles.

1.08 SUBMITTAL OF FINAL OPERATION AND MAINTENANCE MANUALS

- A. Schedule: Submit final manuals no later 30 days following the satisfactory completion of Acceptance tests for the subject system or equipment.

- B. The requirements specified in this Article apply to both system and off-the-shelf equipment manuals.
- C. One set of each manual will be returned to the Contractor, marked with review-stamp action-block marks as described in Section 01 33 00 - Submittal Procedures.
- D. Any non-compliant portions of the manual will be noted in the manual or otherwise communicated to the Contractor in writing by the Engineer.
- E. Revise manual returned to the Contractor marked "NOT APPROVED" and resubmit 6 sets for review within 30 days.
- F. If the Engineer returns a manual to the Contractor that is marked "Approved" or "Approved as Noted", make any noted corrections and submit copies of manual to the Engineer in its final printed form.

1.09 LIQUIDATED DAMAGES IN REGARD TO O&M MANUAL SUBMITTALS

- A. Failure of Contractor to obtain approval of each of its submittals within the required schedule of milestones for manuals will make the Contractor liable for liquidated damages. Liquidated damages for each manual and each submittal milestone are specified in the Contract Specifications Section 01 78 23 - Operation and Maintenance Data. Liquidated damage amounts specified are per day and will be assessed for each day that approval is not obtained past milestone date for obtaining approval of particular submittal. Liquidated damages for each manual and each submittal milestone are separate and cumulative. These liquidated damages are distinct and separate from liquidated damages specified in Contract Specifications Section 01 11 00 - Summary of Work.

1.10 OFF-THE-SHELF EQUIPMENT MANUALS

- A. Obtain through the Engineer a book number assigned by the District Technical Publications Administrator for each manual.
- B. Manuals shall consist of a legible copy of the manufacturer's operating instructions and other operation and maintenance information available from the manufacturer.
- C. Manuals shall include legible copies of manufacturer's catalog cuts with specific items bubbled or clearly marked with arrows. When it would be clearer to cross-out irrelevant portions of a page, neatly cross-out irrelevant information using a straight-edge. Manuals shall include catalog pages, manufacturer's pre-printed maintenance and operations instructions, wiring diagrams, parts lists, warranty slips, and manufacturer's certificates, as applicable and as required by the Engineer.
- D. Manuals shall contain a Table of Contents that reflects all procedure numbers, page numbers, figure numbers, and tables, as well as the volumes, chapters and/or sections of each manual.
- E. Divide each chapter or section of the manual using divider pages that comply with the requirements specified in Article 1.13 herein.
- F. Manuals for HVAC, Plumbing and Fire Protection equipment shall list the following information:

1. Equipment identification
2. Make and model
3. Location of equipment
4. Filter sizes and quantities
5. Service and dealer directory shall include the authorized dealer name, phone number, address, email address, and web site for each piece of equipment.
6. Valve directory shall include the valve number, type, size, location and function.
7. Damper certification and verification.
8. Domestic water system cleaning and disinfection test results and report.
9. Air and water system balance reports.
10. Controls operation and maintenance data with wiring diagrams.
11. Approved seismic restrain inspection report, certified by professional licensed Seismic Engineer or approved representative.
12. Warranties: Submit effective date, expiration date, extent of warranty, name and contact information of firm providing warranty.

G. Binders for each manual shall comply with the requirements specified in Article 1.13 herein with the following exceptions:

1. Binders shall be white and have clear plastic slip-in pockets on cover and spine. Label cover and spine with slip-in printed sheets in accordance with format provided by the Engineer.
2. Artwork for covers, spines, and front cover page shall be provided by the Contractor in accordance with the format and prototypes provided by the Engineer.

1.11 NATIVE ELECTRONIC FILE FORMAT FOR SYSTEM MANUALS

- A. The native electronic file formats are the programs used to create the Operation and Maintenance Manual.
- B. Text pages shall be created using MS Word, latest release in use by the District.
- C. Parts Lists created for Chapter 7, titled "Illustrated Parts Catalog"(all Volumes), shall be created using MS Excel, latest release in use by the District.
- D. Illustrations and drawings, including technical illustrations, shall be created using AutoCAD, latest release in use by the District, in accordance with the Contract Drawings CADD Requirements in the Appendices/ District Technical Manuals of the BART Facilities Standards. Contract Drawing CADD Requirements Appendix is available upon request.

- E. Text pages containing illustrations shall have the AutoCAD files inserted into the MSWord file as an object. AutoCAD files shall have a white background.

1.12 FORMAT AND TECHNICAL CONTENT FOR SYSTEM MANUALS

- A. Each manual shall meet the following requirements:

1. Have degree of detail as specified in ATA Specification 2200.
2. Be developed in conjunction with maintainability requirements.
3. Be organized so that each major subsystem is treated as an integrated system and not as a grouping of disassociated parts.
4. Contain data required to maintain equipment during equipment service life.
5. Contain data required to operate and maintain test equipment during equipment service life.
6. Contain no extraneous information, such as advertisements or company or manufacturer's logos. Any reference to the manufacturer or contractor, other than necessary references to the equipment in the text, is considered advertisement. Manufacturer or contractor's name shall not appear in the page titles, headers, footers or anywhere else in the document.
7. Contain all operating instructions. If required, provide a separate operating manual.
8. Drawings and illustrations shall include details necessary for the installation, maintenance, and repair of equipment provided.

- B. Numbering and Content Minimum Requirements:

1. Obtain through the Engineer a book number assigned by the District Technical Publications Administration for each manual.
2. Each manual shall be composed of one or more volumes titled and organized by subject matter. Each volume may be contained in one or more binders, if necessary, and shall be designated accordingly (i.e. Volume 1A, Volume 1B, Volume 1C, etc.). Manuals for complex, multi-component systems may be organized into volumes with each volume covering a subsystem or component of the greater system. Multiple volumes shall be used when specified in the Contract Specifications, when required by the Engineer, or when proposed by the Contractor and accepted by the Engineer.
3. Each volume shall be consecutively numbered (i.e. Volume 1, Volume 2, Volume 3, etc.).

- C. Manual (or Volume in the case of multi-volume manuals) shall contain a Table of Contents and be organized into nine specific chapters as outlined herein.

1. Chapter 1 – General Information and Specification
2. Chapter 2 – Theory of Operation

3. Chapter 3 – Troubleshooting
 4. Chapter 4 – Primary Repair
 5. Chapter 5 – Secondary Repair (Component Level)
 6. Chapter 6 – Preventive Maintenance
 7. Chapter 7 – Illustrated Parts Catalog
 8. Chapter 8 – Miscellaneous
 9. Chapter 9 – Wiring Diagrams
- D. Table of Contents shall reflect procedure numbers, page numbers, figure numbers, and tables, as well as the volumes, chapters, and sections of each manual, as applicable. Table of Contents shall list and contain the following:
1. Chapter titles
 2. Section titles
 3. Subsection titles and corresponding page numbers
 4. Drawing titles, numbers and corresponding page numbers
 5. Figure titles, numbers and corresponding page numbers
 6. Table titles, numbers and corresponding page numbers
 7. Procedure numbers and corresponding page numbers.
- E. Chapters shall comply with the following requirements:
1. Chapter 1 – “General Information and Specifications”
 - a. A “List of Acronyms and Abbreviations” in the form of a table.
 - b. General non-technical description of equipment, including interface relationships and general functions.
 - c. Pictorial views of the subassembly components and parts described.
 - d. Tables listing the performance specifications of equipment.
 2. Chapter 2 – “Theory of Operation” shall provide a technically detailed description of equipment, by subsystem, including:
 - a. Location of parts in subassembly or component being discussed.
 - b. Location, function, and operation of pertinent controls, gauges, indicators, and switches.

- c. Subsystem setup and shutdown procedures.
 - d. Trouble symptoms and first-response diagnostic methods.
 - e. Emergency procedures and safety requirements.
 - f. Electrical wiring diagrams, electronic schematics, and mechanical configurations.
 - g. Block diagrams of provided subsystems, signal flow diagrams, including interface connections to other subsystems.
 - h. Applicable charts, figures and drawings to be located at the end of text for each subsystem.
3. Chapter 3 – “Troubleshooting” shall contain:
- a. Necessary information for troubleshooting and fault isolation.
 - b. Charts and tables as applicable listing symptoms and probable causes of improper operation or failure of subsystem and probable remedies.
4. Chapter 4 – “Primary Repair” shall contain the following information to allow maintenance to be performed at equipment location site:
- a. Detailed corrective maintenance procedures to be performed on equipment shall include particulars on testing alignment, adjustment and tuning. Include detailed views of mechanical parts or schematics for tests.
 - b. Step-by step procedures of installation and removal of components and subassemblies (field replaceable units).
 - c. Procedures for use of special test equipment.
 - d. Warning and caution notes as required.
 - e. Applicable charts, figures, and drawings to be located at the end of text for each subsystem.
5. Chapter 5 – “Secondary (Component) Repair”, shall contain the following in regard to maintenance to be performed in a shop other than equipment location site:
- a. Detailed corrective maintenance procedure to be performed on subassemblies and components shall include particulars on testing alignment and tuning. Include detailed views of mechanical parts or schematics.
 - b. Step-by-step procedures for installation and removal of parts in assemblies and components.
 - c. Procedures for use of special test equipment.
 - d. Incorporate warning and caution notes, as required.

- e. Applicable charts, figures and drawings to be located at the end of text for each subsystem.
6. Chapter 6 – “Preventive Maintenance”, shall contain:
 - a. Preventive maintenance procedures, schedules, and tables including lubrication requirements and frequency of application.
 - b. Inspection and maintenance standards, including wear limits, settings, tolerances, and criticality of tolerances.
 - c. Storage instructions for spare parts, special tools and test equipment.
 7. Chapter 7 – “Illustrated Parts Catalog”, shall contain:
 - a. Instructions for use of Illustrated Parts Catalog.
 - b. Index by subassembly.
 - c. Illustrations which are exploded views of assemblies, components, and parts with leader lines and circled callout numbers to each item.
 - d. Detailed Parts List, including:
 - 1) Figure Number
 - 2) Part index number, not to exceed 19 alphanumeric characters
 - 3) Space to allow for insertion of the District’s nine-digit stock number (group, subgroup, part no.)
 - 4) Description of part, including manufacturers and vendor’s part number
 - 5) Equivalent parts available from other manufacturers.
 - 6) Disposition of part (repairable, non-repairable, etc.)
 - 7) Quantity required per assembly
 8. Chapter 8 – “Miscellaneous”, shall contain information that is deemed inappropriate for any other chapter including descriptive brochures, manufacturer’s certificates and warranty slips.
 9. Chapter 9 – “Wiring Diagrams”, shall contain:
 - a. Applicable electrical, electronic, pneumatic, and schematic diagrams.
 - b. Wiring diagrams, including wire color code, size, and rating; terminal and connector pin numbers; and plug and socket numbers.
 - c. Pin-to-pin description of each wire, using wire-marking format. Additionally, wires at each terminal block and each connector shall be independently identified and cross-referenced at the next terminating point.

- d. Diagram size in accordance with that previously stated in these specifications.
- e. PCB layout diagrams (artwork) for non-standard and non off-the-shelf printed circuit (PC) boards.

F. Front Cover Page Specifications

1. Front cover page shall be on white bond paper, 8.5" x 11", 60-pound minimum.
2. The Engineer will provide artwork for the front cover page. Artwork will include the District's logo artwork, title of the manual, book number, volume, user name, issue date, and the District's name, address and phone number.
3. Reproduce provided artwork.

G. Paper, Page Layout and Page Numbers

1. Paper used for text and drawings shall be 40-pound bond grade paper. All pages, except for drawings, shall be 8.5 x 11 inches, portrait style. Drawing pages shall be 8.5 x 11 inches or 11 x 17 inches.
2. Pages shall be 3-hole punched.
3. Pages shall be printed double-sided except 11 x 17 inch drawings.
4. Left, right and top margins shall be set at one inch from edge of page; Last line of body text shall be set 1.5 inches from bottom of page; last line of footer text shall be set 0.75 inch from bottom of page.
5. Page numbering depends on the size of the manual. Larger manuals shall be broken up into volumes and have sectional page numbers while smaller ones may be in chapters and sections, and have sequential page numbers (1,2,3).
6. As a general rule, number pages Chapter-Section-Page. If the chapters aren't broken down into sections, number pages Chapter-Page. Any drawings or illustrations within each chapter shall have figure numbers, also reflecting Chapter-Section-Figure. The same applies for tables.
7. The page number shall appear at the bottom of the page with the book number on the first line, the volume number (if applicable) on the next line and the page number on the last line. Example: Book 50, Volume 10, Page 4-9-1. If the book doesn't have a volume number, the Book number shall appear first, the chapter number shall appear on the next line and the page number on the last line.
8. For double-sided pages, the book, volume, chapter and page numbers shall appear at the bottom of the page, alternately, beginning on the right side for the first and odd-numbered pages of each chapter or section, and the left side for the even-numbered pages. If the book is printed one-sided, the numbers shall appear on the bottom, right-hand corner of each page.
9. The revision date shall appear at the bottom center on all pages with Rev. and the month (first three letters) a forward slash, and the year (last two numbers). Example: Rev. Dec/94.

10. New sections and chapters shall begin on a right-hand facing page. At the end of each chapter or section if there is a blank left-hand page, print on the left-hand page, "This page intentionally left blank," in 10 pt. Arial, or whatever the body text of the document is.
11. Fan-fold 11 x 17 inches pages to 8.5 x 11 inches. For pages larger than 8.5 x 11 inches, display page identification on last fold of folded page so as to be readable without unfolding.
12. Each 11 x 17 inch illustration shall be considered as one page. There shall be no double page numbering (Example: Page 11/12).

H. Font and Paragraph Layout: Samples will be provided upon request.

1. Body text shall be 10 pt. Arial font, except as otherwise specified.
2. Body text shall be left justified, ragged right and single-spaced, with 12 pt separating paragraphs.
3. Titles and first level headers shall be 10 pt. Arial, unless otherwise specified, bold and all caps. Second level headers or subheadings shall be 10 pt. Arial, bold, and upper and lower case.
4. Titles of procedures shall be all caps, bold, and centered on the page.
5. Bullets:
 - a. First level bullets shall be solid style and indented once under margin of last level text, with one space between bullet and beginning of text.
 - b. Next level bullets (used when listing information below a bullet) shall be dash style and indented twice with one space between dash and beginning of text.
6. Indents shall be 0.5" (five spaces).

I. Notice Messages:

1. Notice Messages: Warnings, Cautions and Notes are notice messages. They shall all be in bold type with no lines or borders around them. Notice messages shall be formatted as follows:
 - a. "WARNING!" is the most important. It denotes something that is life threatening or can severely damage the equipment or system if the procedure is not followed properly. Warnings shall be in all caps, bold, and flush with the section in which they appear. Warnings shall end with an exclamation point.
 - b. "CAUTION:" is used when injury or equipment damage can occur if procedure is not followed properly. Cautions shall be all caps, bold, indented, and flush with the section in which they appear. Cautions shall end with a colon.
 - c. "Note:" flags important information. Notes shall be bold, two points larger than the regular body text, and in upper and lower case. Notes shall be indented under margin of last level text (but not underlined).

J. Technical Illustrations:

1. Draw illustrations, including “exploded” views and illustrated part breakdowns. Utilize illustrations to facilitate descriptions of assemblies and the relationships of components, subsystems, and systems. Illustrations shall conform to the requirements and the recommendations of referenced ATA and ANSI Standards.
2. Technical illustrations shall comply with the following requirements:
 - a. Illustrations shall include details necessary for the installation, maintenance and repair of all equipment provided.
 - b. Each illustration shall be designated as a “figure”. The word "Figure," accompanying numerical designation and caption shall be the same size, style, and type as the written text. Its physical location shall be the same on each page.
 - c. Figure numbers and descriptions of figures shall be readable in the horizontal position as you read the page from left to right.
 - d. Figures containing graphics, illustrations, diagrams, and similar drawings, shall appear at the end of the applicable section or procedure.
 - e. Pages containing illustrations, charts and tables shall be size 8-1/2 x 11 inches or 11 x 17 inches (fan-folded to 8-1/2 x 11 inches). Pages which are 11 x 17 inches shall be landscape style. These also include Chapter 9 drawings.
 - f. Folded sheets shall display identification on last fold, readable without unfolding.
 - g. Whenever callout numbers are used in an illustration, they shall be circled.
 - h. Graphic symbols used for electrical and electronics shall conform to ANSI Y32.2.
 - i. Graphic symbols used for logic diagrams shall conform to ANSI Y14.
 - j. Drawing file and drafting requirements including line convention and lettering shall conform to the District Technical Manual entitled Contract Drawing Preparation in the BART Facilities Standards, Appendices.

K. Revisions to Text and Drawings:

1. Revisions shall be made for design changes, retrofits, and errors as required, and based upon changes generated during testing. These revisions shall be listed on a List of Effective Pages to be issued with each review submittal and revision of the manuals until expiration of the Contract.
2. Include at the beginning of each completed manual or volume, a Configuration Control Record form adhering to the format provided by the Engineer. Form shall include columns for the chapter, page number, BECO number, revision number, revision date, and revision description.

3. Refer to Article entitled "Manual Revision Control" herein for revision requirements applicable to revisions to final draft and approved manuals.

1.13 PRINTED MANUAL REQUIREMENTS

A. Binder Specifications:

1. Manuals shall be bound in three-ring, O-ring binders, ranging in thickness from one to three inches depending on the size of each volume. If the Engineer accepts use of binders with a thickness greater than 3 inches, binders shall be heavy-duty type acceptable to the Engineer. Binders shall be white in color and have clear plastic slip-in pockets on cover and spine. Cover material shall be virgin vinyl .014 ga. inside and out, sealed over 120 point chip board with serrated hinges. Binders shall be durable and capable of long-time service in maintenance shop environment. Covers shall be oil, water, and wear resistant. Rings shall not bend or misalign under normal shop conditions and should be able to hold contents with bending or misaligning. Binder rings shall be manufacturer's standard diameter designed to accommodate standard three-hole punching. Binders shall contain front and back plastic sheet lifters.
2. The Engineer will provide artwork for front cover and spine. Label cover and spine with slip-in printed sheets in accordance with format provided by the Engineer. Artwork for front cover and spine will include the name of the manual, volume, book number printed in a visible location. Artwork will include San Francisco Bay Area Rapid Transit District, 300 Lakeside Drive, Oakland, California 94612 printed in the lower left hand corner of the cover. Artwork on spine shall begin one inch from top of spine.
3. Maximum size of binders shall be 11.5 inches high and 11 inches wide.
4. Binders shall accept 8.5 x 11 inch pages.
5. Manuals shall lie flat when opened. Pages shall not bind or join when turned for normal reading.
6. Manuals shall allow enough space for insertion of revised pages.

B. Divider Page Specifications: Each chapter including the table of contents shall have divider tabs. The chapter number and title shall be printed on both sides of the tab.

1. Divider pages with tabs shall be white in color, 8.5 x 11 inches in size, card stock, and three hole punched for ring binders. Holes shall be reinforced with a strip of mylar.
2. Tabs shall be white in color with 3/8 inch extension with rounded corners and shall comply with the following requirements:
 - a. Have bold capital letters, Arial font, using black ink and printed on both sides.
 - b. Have five tabs per bank type with mylar-reinforcement on both sides of tab.
 - c. Slide-in type tabs are not acceptable.

3. Sample of divider tab will be available upon request.
- C. Final Assembly: All hard copies shall be printed out, assembled, and placed in binders. Each volume (if applicable) or book shall be assembled in the following order:
1. The first section for each volume or book shall contain the cover sheet for that volume/book, the BART Configuration Control Record for that volume/book and the master Table of Contents listing all of the chapters for the entire volume/book. When a volume is contained in more than one binder, each binder shall include a cover sheet, and master Table of Contents for the entire volume/book.
 2. Each subsequent chapter shall contain a Table of Contents listing all of the pages and sections in that chapter.

1.14 ELECTRONIC VERSION OF MANUAL (eManual) FOR SYSTEM MANUALS

- A. The eManual shall be created from the native electronic files, as specified in Article 1.11 entitled "Native Electronic File Format", using Adobe Acrobat, (latest release in use by the District.
- B. Each PDF file shall contain a chapter and each file shall be named according to its book number, volume, and chapter (example: BkXXvol01chap01.pdf).
- C. Each chapter shall have a Table of Contents which includes the following:
1. Section Titles
 2. Sub-section titles and corresponding page numbers
 3. Drawing titles, numbers and corresponding page numbers
 4. Figure Titles, numbers and corresponding page numbers
 5. Table titles, numbers and corresponding page numbers
- D. Each item listed in the Table of Contents shall hyperlink to the corresponding sub-section, drawing, figure, or table.
- E. The Table of Contents shall have Bookmarks to all corresponding pages.
- F. Any references to Figures or Tables within text pages shall be hyperlinked to the referenced document(s).
- G. In Chapter 7, entitled "Illustrated Parts Catalog", each item number callout in the illustration will be linked to the corresponding sub-assembly or line item number listed in the Parts List.
- H. Link properties shall be as follows unless otherwise noted or approved by the Engineer:
1. Type: Invisible Rectangle
 2. Highlight: None

3. Action Type: Go to View

- I. All Chapter PDF files for each Volume shall be on the same CD. The CD shall be labeled according to the book number, book title, volume number, volume title, and creation date.
- J. Each CD shall have a PDF file of the Volume's Table of Contents. The file shall be named according to the book number, volume number, Table of Contents (example: BkXXvolXXTOC.pdf). The Table of Contents shall be linked from the Chapter listing to the Chapter PDF file. The links shall enclose the complete Chapter listing and use the same properties as described above with the exception being the Action Type shall be "Open File".

1.15 MANUAL REVISION CONTROL

- A. Revisions of final draft and approved manuals shall be listed on a Configuration Control Record form in the front of each manual. The list shall be issued with each revision and shall show the date of each revision and the page reference.
 - 1. Contractor shall maintain updated lists and revisions in the manuals until the warranty period expires. Revisions shall be prepared prior to the arrival of altered components, and as soon as possible after procedures are changed or errors are found.
 - 2. Contractor shall provide revisions to the approved manuals on a not less than quarterly basis during the first 12 months after the final manuals are delivered, and then on a not less than semi-annual basis for the duration of the warranty period.
 - 3. Contractor shall issue revisions related to major alterations of principal subsystems or assemblies prior to the arrival of components.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 78 23

BART Facilities Standards (BFS)

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SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Maintenance of Record Documents.
- B. Drawings.
- C. Specifications.
- D. Submission of documents.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintain at the jobsite one copy of the following documents for record purposes:
 - 1. Conformed Contract Documents. One set of full size 22 by 34 inch prints shall be maintained for recording "as-built" revisions and special features.
 - 2. Change Orders.
 - 3. Approved Submittals.
 - 4. Clarifications or Explanatory Details and Specifications.
 - 5. Inspection Reports.
 - 6. Laboratory Test Records.
 - 7. Field Test Reports and Records.
 - 8. Factory Test Reports and Records.
- B. Maintain for record purposes at a location approved by the Engineer, electronic files for those shop drawings and other documents which are required to be submitted electronically. Ensure that backups of electronic files are made on a regular basis and stored at a remote location.
- C. Store documents used for record purposes in the Contractor's field office or other approved location, apart from documents used for construction. Do not use record documents for construction or fabrication purposes.
- D. Provide files and racks for storage of documents.

- E. File documents in accordance with the filing format of the Contract Specifications, by Section number and title.
- F. Maintain documents in clean, dry, legible condition.
- G. Label each document "Project Record".
- H. Make documents available at all times for inspection by the Engineer. Make copies of electronic documents available upon Engineer's request.

1.04 DRAWINGS

- A. Record ("As-Built") Drawings:
 1. Maintain record ("as-built") drawings of all work and subcontracts, continuously as the job progresses. A separate set of prints, for this purpose only, shall be kept at the Contractor's field office at all times.
 2. These drawings shall be kept up-to-date and are required to be so certified by the Engineer at the time invoices are submitted for progress payments. The Engineer may withhold progress payments if record drawings are not kept current.
 3. The District will furnish the Contractor a complete set of full-size copies of the Contract Drawings for the purpose of making prints for record ("as-built") drawings.
 4. Deviations from the drawings, utilities and services, mechanical and electrical lines, details, and other work shall be incorporated on the record ("as-built") prints in red ink, or in red pencil if sharp, neat, and clearly legible.
 5. During the course of construction, identify actual locations to scale in red ink on the Contract Drawings for runs of mechanical and electrical work, including utilities and services, installed in walls, or otherwise concealed. Deviations from the Drawings shall be shown in detail. Locate main runs, whether wiring, piping, conduit, ductwork, or drain lines by dimension and elevation. Shop Drawings may be used to reflect record ("as-built") conditions, in which case the appropriate Contract Document shall be marked to refer to such Shop Drawings as part of the record ("as-built") configuration.
 6. No work shall be permanently concealed until the required information has been recorded.
 7. Where the Contract Drawings are not of sufficient size, scale, or detail, the Contractor shall furnish its own drawings for incorporation of details and dimensions.
 8. The final submittal of record ("as-built") drawings shall be stamped "Project Record ", signed and dated in blue ink by the Contractor, and shall be delivered to the Engineer prior to the final inspection as specified in Section 01 77 00, Closeout Procedures.

B. Change Orders:

1. Changes to the Contract Drawings as the result of Change Orders shall be incorporated on the prints, and these changes shall be identified by Change Order number and effective date.
2. When revised Contract Drawings are issued as the basis of, or along with, Change Orders, these revised drawings shall be incorporated into the record ("as-built") set with appropriate annotation. Drawings deleted by Change Order will not be part of the record ("as-built") set. The District will furnish the Contractor with reproductions of such revised District-furnished Contract Drawings.

C. Submittals:

1. One complete set of approved Submittals, including shop drawings, product data, manufacturers' printed catalog cuts and data, shall be collected and maintained for record purposes.
2. Pages of catalog cuts shall be clear, legible, and permanent. The drawings shall be on vellum or bond paper. Blueprints will not be acceptable. These drawings and catalog cuts shall become the property of the District.
3. Submittals shall be filed and maintained separate from Contract Drawings and Shop Drawings. Documents shall be filed in 9 inch by 12 inch file folders to the greatest extent possible and shall be indexed as herein before specified.
4. Submittals shall be delivered in new paperboard boxes manufactured for the storage of file folders. Boxes shall have covers and cutout handles, and shall be accurately identified as to the contents. Include a packing list of all boxes and their contents.

D. Electronic Documents: Record ("as-built") information, as applicable, shall be recorded on an electronic copy of those documents which are required to be submitted electronically.

1. For those drawings which are required to be submitted electronically, submit one complete set of full size (22 by 34 inch, unless otherwise required) hard copy originals plotted on 20 lb. bond paper, zero solvent. The image shall be pressure-fused using a laser or LED plotter. Inkjet plotter is also acceptable. Sepia, blue or brown lines are not acceptable.
2. Record documents for each submittal which was required to be prepared and submitted electronically shall include two CD-ROMs of the electronic version. Electronic files shall include a matrix or document showing how the files are set up and how to access them. Include no extraneous files. Folder arrangement must be clear and understandable and subfolders are to be used only when necessary.

1.05 SPECIFICATIONS**A. Contract Specifications:**

1. The specifications for record purposes shall be filed in one or more large-ring, 3-ring binder or binders.
2. Information, changes, and notes shall be recorded in the specifications in blank areas, such as page margins or the backs of opposite pages, or on separate sheets inserted in the binder. All such information, changes, and notes shall be legibly recorded with red pen or red printing as appropriate.
3. In applicable specification sections, record the manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually furnished and installed, including manufacturer and supplier's address and telephone number.
4. The record specifications shall be complete and shall include all applicable Contract Documents other than drawings.

B. Change Orders:

1. Change Orders shall be incorporated into the front of the record specifications in reverse chronological order. Use appropriate page dividers to identify Change Orders and to separate Change Orders from the Specifications.
2. In addition, changes to the Specifications effected by Change Order shall be legibly annotated on the affected page or pages of the Specifications or adjacent thereto.

1.06 SUBMISSION OF DOCUMENTS

A. At completion of the Work, and before requesting final inspection, deliver record documents to the Engineer.

B. For record ("as-built") drawings, submit the blackline print (full size) with revisions incorporated on the prints in red ink. For those documents which are required to be maintained electronically, submit full size plot of drawings, hard copies of 8 1/2 by 11 inch documents, and electronic files on CD-ROM.

C. Software:

1. Submit all documentation, licenses, and electronic media associated with the purchase of commercially available software furnished to the District under this Contract. The documentation and media shall be submitted in appropriate storage containers or in the original media packaging.
2. Where development of User's Guides is specified, User's Guides shall be submitted.
3. Unless otherwise specified, documentation shall be prepared in accordance with recognized industry standards for such documentation as approved by the Engineer.

PROJECT RECORD DOCUMENTS

- D. Record documents, separate from Contract Drawings and Shop Drawings, shall be delivered neatly and efficiently filed and packaged in appropriate file storage cabinets or boxes, 12 inches by 16 inches in size.
- E. Submission of record documents shall be accompanied with a transmittal letter, in triplicate, containing the following information:
 - 1. Date of submission.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Title and number of each record document. (Shop Drawings may be grouped in basic categories or divisions of work and by box identification.)
 - 5. Certification that each document as submitted is complete and accurate.
 - 6. Signature of Contractor, or its authorized representative.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 78 39

BART Facilities Standards (BFS)

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SECTION 01 78 44

SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Spare parts.
- B. Maintenance materials.
- C. Keys, special tools, and test equipment.

1.02 RELATED SECTIONS

- A. Coordinate the work of this Section with the work specified in Section 01 78 23 - Operation and Maintenance Data, for lists of spare parts.
- B. Keys for finish hardware are specified in Contract Specifications Section 08 71 00 - Door Hardware.

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.
- B. Spare Parts Lists:
 - 1. Prepare and submit a complete list of recommended spare parts for all equipment, appliances, and systems as specified in the various individual Sections of these Specifications, as applicable, and in the Contract Specifications.
 - 2. The Spare Parts List shall include all spare parts as required to provide for the maintenance and repairs of all Contractor-furnished equipment and appliances for a period of two years.
 - 3. The Spare Parts List shall be organized in accordance with the Contract Specifications, by Section number and title.
 - a. The Spare Parts List shall include the part's generic name or description, its trade name, Contractor's part number, manufacturer's name, manufacturer's part number, retail price, quantity, and correlation with the pertinent Contract Specifications, Contract Drawings, and Maintenance Manuals specified in Section 01 78 23 - Operation and Maintenance Data.

- b. Spare parts shall be grouped by equipment category. Replacement parts common to more than one category shall be cross-referenced and indexed. Such common parts shall have only one part number.

C. Maintenance Materials List:

1. Prepare and submit a complete list of maintenance materials as specified in the various individual Sections of these Specifications, and in the Contract Specifications.
2. The Maintenance Materials List shall be organized in accordance with the Contract Specifications, by Section number and title. Include the quantities to be furnished.
3. Where maintenance materials are specified as a percentage of the materials installed, such percentages shall be translated to actual quantities of materials in the Maintenance Materials List.

D. Keys, Special Tools, and Test Equipment List:

1. Prepare and submit a complete list of the keys, special tools, and test equipment as specified in the various individual Sections of these Specifications, and in the Contract Specifications.
2. The Keys, Special Tools, and Test Equipment List shall be organized in accordance with the Contract Specifications, by Section number and title.

1.05 SPARE PARTS

A. Requirements:

1. Provide specific spare parts as specified in the individual Sections of the Contract Specifications.
2. Spare parts shall be identical to the parts installed in the Work.

B. Quantities: Provide quantities based on reliability requirements, replacement lead time, the Contractor's recommendations, and the following requirements:

1. Wear: Provide spare parts for components which may be expected to require regular replacement under normal maintenance schedules, such as mechanical parts subject to continuous operation.
2. Consumability: Provide spare parts for components with a life-expectancy of less than 5 years.
3. One-Time Limited Service: Provide spare parts that normally require replacement after performing their function one time, such as fuses.
4. Long Lead Time: Provide spare parts for components that are not readily available from distributors, such as for custom-fabricated components.

5. Exchange Assemblies: Provide assemblies which will be exchanged with malfunctioning units for installed equipment, and which must be inventoried as complete assemblies.

1.06 MAINTENANCE MATERIALS

A. Requirements:

1. Provide maintenance materials as specified in the individual Sections of the Contract Specifications.
2. Maintenance materials shall be identical to the materials installed in the Work.

B. Quantities: Provide quantities of materials as specified in the individual Sections of the Contract Specifications.

1.07 KEYS, SPECIAL TOOLS, AND TEST EQUIPMENT

A. Requirements: Provide sufficient keys, special tools and wrenches, and special test equipment and gages as required to access, start, maintain, and repair all the installed equipment, appliances, systems, and assemblies as specified in the individual Sections of the Contract Specifications.

B. Quantities: Provide quantities of keys, special tools, and test equipment as specified in the individual Sections of the Contract Specifications.

1.08 BAR CODE

A. All spare parts with the manufacturer's or supplier's serial number or other identification shall also be identified with bar codes, coded in accordance with the District's Bar Coding System (AIAG Auto Industry Code 39) or equivalent. The System details will be provided by the Engineer.

1.09 PACKAGING

A. Comply with applicable requirements of Section 01 60 00 - Product Requirements. All spare parts, maintenance materials, keys, special tools, and test equipment shall be securely packaged in boxes, with the boxes clearly labeled as to the contents. Such labeling shall include: location and description of the equipment and the item, complete listing of all items in the box, and the quantity of each item included in the box.

1.10 DELIVERY

A. Deliver spare parts, maintenance materials, keys, special tools, and test equipment to the warehouse location or locations specified in the Contract Specifications. Provide unloading service at the designated storage location for all delivered products.

B. Prepare formal receipts for all such delivered products, and have them signed by the authorized District Representative at the location. A copy of all such receipts shall be submitted to the Engineer for information and record.

1.11 STORAGE

- A. Spare parts, maintenance materials, keys, special tools, and test equipment may be stored temporarily at the site of the work in suitable storage facilities until time to deliver these products to the locations designated in the Contract Specifications. Any such storage shall comply with the requirements specified in Section 01 60 00 - Product Requirements.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 78 44

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Training sessions.
- B. Training manuals and training aids.

1.02 MEASUREMENT AND PAYMENT

- A. Separate measurement or payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.03 TRAINING SESSIONS

- A. General:
 - 1. Prior to final inspection and acceptance, instruct and train the District's designated operating and maintenance (O&M) personnel in the operation, start-up and shut-down, adjustment, troubleshooting, servicing, and preventive maintenance of all equipment and systems.
 - 2. Explain to the District's O&M personnel, in full and to their complete understanding, all procedures necessary to operate and maintain all equipment and systems on a continuing basis.
 - 3. Provide training manuals and other instructional materials and teaching aids as required to properly perform the required instruction and training.
 - 4. Review the contents of all O&M Manuals specified in Section 01 78 23 - Operation and Maintenance Data, with the District's O&M personnel in full detail to explain all aspects of the Manuals and the operation and maintenance of all equipment and systems.
 - 5. Provide classroom and on-site instruction as most appropriate for the particular equipment or system or as specified more specifically in the individual specifications sections.
 - 6. Provide the services of manufacturers' representatives for instruction and training when special equipment and systems require the knowledge and expertise of the various manufacturers for the proper operation and servicing of such equipment and systems.
 - 7. Operation and maintenance manuals are specified in Section 01 78 23 - Operation and Maintenance Data, and may be used for training manuals where appropriate.

8. Various specific and detailed requirements for instruction and training of BART personnel are specified in the individual Sections of these Specifications, as applicable, and in the Contract Specifications.

B. Classroom Sessions:

1. The Contractor shall provide instruction and training sessions in the operation and maintenance of all equipment and systems for BART O&M personnel prior to acceptance by the Engineer of the affected work.
2. Training sessions shall be conducted by representatives of the various equipment and product manufacturers and the Subcontractors who are involved in the installation and acceptance testing of the affected equipment and systems. Training sessions shall enable a qualified service technician to troubleshoot and sustain the equipment and systems.
3. The Engineer will provide a classroom facility for such instruction and training sessions, located in a BART facility in Oakland, California. Approximately fifteen BART maintenance persons will attend each training session.
4. The Contractor shall schedule the training sessions through the Engineer at a time convenient to the District. The Contractor shall notify the Engineer of the proposed training sessions at least 30 days before the dates the training will be held.

C. On-Site and Hands-on Sessions: Provide on-site, hands-on training sessions as required to demonstrate actual maintenance procedures on the equipment. Hands-on training shall provide BART personnel with actual maintenance experience.

C. Videotaping Rights: The Engineer shall have the right to videotape any and all training sessions presented by the Contractor. The Engineer shall also have the right to use these videotapes for future BART-conducted training courses.

1.04 TRAINING MANUALS AND TRAINING AIDS

A. The Contractor shall provide training manuals to supplement the O&M manuals specified in Section 01 78 23 - Operation and Maintenance Data, and submit them to the Engineer for review and approval at least 60 days before the scheduled start of training sessions. Training manuals shall be prepared specifically for use as training aids.

B. Provide each training-session participant with one copy of pertinent training manuals and pertinent O&M manuals before the start of training sessions. Provide the Engineer with two additional training manuals for file and reference documents.

C. Upon completion of each training session or course of instruction, instructor's manuals, training manuals, training aids, special tools, and O&M manuals shall become the property of the District. Provide the Engineer with all revisions to the training manuals throughout the Contract and Guaranty periods.

D. The District reserves the right to copy all training manuals and training aids for use in District-conducted training courses.

- E. The Contractor shall provide all special tools, equipment, training aids, and other materials required for the training of BART personnel. The number of special tools and other training equipment shall be adequate for the number of participants attending the training sessions.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 79 00

BART Facilities Standards (BFS)

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5.2 Division 2

Existing Conditions

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SECTION 02 41 00

DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Permits.
- B. Site conditions.
- C. Materials, equipment, and facilities.
- D. Preservation of reference markers.
- E. Demolition.
- F. Removal.
- G. Salvage.
- H. Disposal of removed materials and debris.

1.02 RELATED SECTIONS

- A. Temporary facilities, such as fences, barricades, warning lights, and other temporary safety measures, are specified in Section 01 52 00 - Construction Facilities.
- B. Dust control is specified in Section 01 57 00 - Temporary Controls.
- C. Selective demolition and removal for renovation of existing buildings, structures, and facilities are specified in Section 02 41 19 - Selective Structure Demolition.
- D. Removal of vegetation and trees is specified in Section 31 11 00 - Clearing and Grubbing.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement:
 - 1. Demolition will be measured for payment by the lump-sum method, acceptably performed and completed.
 - 2. Material and placement for backfill will be measured separately for payment as specified in Section 31 00 00 - Earthwork.
- B. Payment:
 - 1. Demolition will be paid for at the Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.
 - 2. Compacted backfill will be paid for as specified in Section 31 00 00 - Earthwork.

1.04 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A10.6 Safety Requirements for Demolition Operations
- B. State of California, Department of Transportation (Caltrans), Standard Specifications, Section 15, Existing Highway Facilities.

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing codes:
 - 1. California Code of Regulations (CCR), Title 8, Chapter 4, Subchapter 4 – Construction Safety Orders.
 - 2. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 33, “Site Work, Demolition and Construction.”

1.06 DESCRIPTION

- A. Demolition as follows:
 - 1. Buildings and structure foundations, footings, and foundation systems shall be completely removed.
 - 2. Utility services to facilities to be removed or demolished shall be disconnected, cut, and capped.
- B. Removal of at-grade structures, such as existing pavements, curbs, gutters, sidewalks, and designated utility structures.

1.07 PERMITS

- A. The Contractor shall obtain all special permits and licenses and give all notices required for performance and completion of the demolition and removal work, hauling, and disposal of debris.

1.08 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Demolition Plan: Submit a comprehensive demolition plan, describing the proposed sequence, methods, and equipment for demolition, removal, and disposal of structure(s); include salvage if required. Do not proceed with demolition until the Engineer has given written approval of the demolition plan.

DEMOLITION

1. Shop Drawings: Include drawings in plan of all structures to be demolished. Indicate stages or phases of the demolition work.
- C. Permits: Submit copies of demolition, hauling, and debris disposal permits and notices for record purposes. Include description of proposed haul routes.
- D. Utility Severance Certificates: Provide certificates, issued by the utility owners, of severance of utility services for record purposes.
- E. Private Property Owner's Release: If material demolished and removed from the site will be deposited on private property, submit two copies of written releases not more than 15 days before the start of work. Releases shall absolve the District from responsibility in connection with the depositing of material on private property, and shall be signed by the owners of such property on which the material will be deposited.
- F. Record Documents: Provide copies of all approved submittals, specified herein, for record purposes in accordance with the requirements of Section 01 78 39 - Project Record Documents.

1.09 SITE CONDITIONS

- A. Protection of Persons and Property:
 1. Install chain link fencing around the area of demolition work as specified in Section 32 31 13 - Chain Link Fences and Gates. Comply with applicable requirements of Section 01 52 00 - Construction Facilities.
 2. Erect and maintain temporary bracing, shoring, lights, barricades, signs, and other measures as necessary to protect the public, workers, and adjoining property from damage from demolition work, all in accordance with applicable codes and regulations.
 3. Open depressions and excavations occurring as part of this work shall be barricaded and posted with warning lights when accessible through adjacent property or through public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 4. Protect utilities, pavements, and facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by demolition operations.
- B. Protection of Utilities:
 1. Protect active sewer, water, gas, electric, and other utilities; and drainage and irrigation lines indicated or, when not indicated, found or otherwise made known to the Contractor before or during demolition work. If utility is damaged, immediately notify the utility owner for corrective action.

DEMOLITION

2. Arrange with and perform work required by utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.
- C. Noise and Dust Abatement: Comply with requirements specified in Section 01 57 00 - Temporary Controls, and the following:
1. Provide continuous noise and dust abatement as required to prevent disturbance and nuisance to the public and workers and to the occupants of adjacent premises and surrounding areas. Dampen or cover areas affected by demolition operations as necessary to prevent dust nuisance.
 2. When a certain level of noise is unavoidable because of the nature of the work or equipment involved, and such noise is objectionable to the occupants of adjacent premises, make arrangements with the jurisdictional authorities to perform such work or operate such equipment at the most appropriate time periods of the day.
- D. Unknown Conditions:
1. The Contract Drawings and related documents may not represent all surface conditions at the site and adjoining areas. The known surface conditions are as indicated, and shall be compared with actual conditions before commencement of work.
 2. Existing utilities and drainage systems below grade are located from existing documents and from surface facilities such as manholes, valve boxes, area drains, and other such surface fixtures.
 3. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to ensure that the service provided is not interrupted, and do not proceed with the work until written instructions are received from the Engineer.
 4. Thickness of existing pavements are from previous construction documents, and do not imply the actual depth or thickness of the total pavement or base material, where it occurs. Remove pavement of whatever thickness as required.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. The Contractor shall furnish all materials, tools, equipment, devices, appurtenances, facilities, and services as required for performing the demolition and removal work.
- B. Materials used for backfill shall conform to the requirements for backfill of Section 31 00 00 - Earthwork.

PART 3 - EXECUTION

3.01 PRESERVATION OF REFERENCE MARKERS

- A. Record the locations and designation of survey markers and monuments prior to their removal. Provide three reference points for each survey marker and monument removed, established by a licensed civil engineer or land surveyor currently registered in the State of California.
- B. Store removed markers and monuments during demolition work, and replace them upon completion of the work. Re-establish survey markers and monuments in conformance with the recorded reference points. Forward to the Engineer a letter verifying re-establishment of survey markers and monuments, signed by a licensed civil engineer or land surveyor currently registered in the State of California.

3.02 DEMOLITION

- A. Perform demolition in accordance with the approved Demolition Plan. Perform demolition work in accordance with ANSI A10.6 and the California Code of Regulations, Title 8 and Title 24, as applicable.
- B. Cap or plug sanitary sewer in accordance with the utility owner's standard details and instructions. Cap and plug pipe and other conduits abandoned due to demolition, with approved type caps and plugs as required by the utility owners.
- C. Backfill and compact depressions caused by excavations, demolition, and removal in accordance with applicable requirements of Section 31 00 00 - Earthwork.

3.03 REMOVAL

- A. Remove existing pavements, structures, and site improvements that interfere with new construction, where demolition is not indicated. Coordinate as required with the work of Section 31 11 00 - Clearing and Grubbing.
- B. Remove walls and masonry construction to a minimum depth of 2 feet below existing ground level in areas where such items do not interfere with new construction.
- C. Slabs may be broken for drainage and left in place where they are below grade and are not detrimental to the structural integrity of the fill or structure to be placed above, as determined by the Engineer.

3.04 SALVAGE

- A. Salvage or reuse materials and equipment as indicated on the Contract Drawings and as specified in the Contract Specifications.
- B. Protect metallic coatings on salvaged items. Remove adhering concrete from salvaged items.
- C. Repair, or replace with new material, salvaged material damaged or destroyed due to Contractor's negligence, as determined by the Engineer.

3.05 DISPOSAL OF REMOVED MATERIALS AND DEBRIS

- A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.
- B. Burying of trash and debris on the site will not be permitted. Burning of trash and debris at the site will not be permitted.
- C. Remove trash and debris from the site at frequent intervals so that their presence will not delay the progress of the work or cause hazardous conditions for workers and the public.
- D. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the District's property and disposed of in a legal manner. Location of disposal site and length of haul shall be the Contractor's responsibility.

3.06 CLEANUP

- A. Provide a clean and orderly site at all times in accordance with Section 01 74 14 - Cleaning.

END OF SECTION 02 41 00

SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Inspection.
- B. Demolition.
- C. Cutting.
- D. Salvaging.
- E. Initial building cleaning.
- F. Disposal of debris.
- G. Restoration of existing structures and facilities.

1.02 RELATED SECTIONS

- A. Temporary facilities, such as fences, barricades, warning lights, and other temporary safety measures, are specified in Section 01 52 00 - Construction Facilities. Provide such additional temporary facilities as may be required to facilitate continuous station or building operations during transitional construction work.
- B. Dust control is specified in Section 01 57 00 - Temporary Controls.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Selective demolition will be measured for payment by the lump-sum method, acceptably performed and completed.
- B. Payment: Selective demolition will be paid for at the Contract lump-sum price, as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A10.6 Safety Requirements for Demolition Operations

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements which govern the work of this Section include the following governing codes:
1. California Code of Regulations (CCR), Title 8, Chapter 4, Subchapter 4, Construction Safety Orders.
 2. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 33, "Site Work, Demolition and Construction."

1.06 DESCRIPTION

- A. The station or building involved in this work will be in continuous operation during the construction period. This will require that the Contractor plan the Work carefully to work around unavoidable obstacles in the prosecution of the Work. It will require further that the Contractor complete some new construction facilities required in the renovation work before removing existing like facilities during transitional work.
- B. Utility services to facilities to be removed or demolished shall be disconnected, cut, and capped, as required.
- C. The work includes restoration of existing structures and facilities to remain in place that are damaged by demolition and removal operations.

1.07 PERMITS:

- A. The Contractor shall obtain all special permits and licenses and give all notices required for performance and completion of the selective demolition and removal work, hauling, and disposal of debris.

1.08 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Selective Demolition Plan: Submit a comprehensive selective demolition plan, describing the proposed sequence, methods, and equipment for demolition, removal, and disposal of structure(s); include salvage if required. Do not proceed with demolition work until the Engineer has approved the selective demolition plan.
- C. Permits: Submit copies of demolition, hauling, and debris disposal permits and notices for record purposes. Include description of proposed haul routes.
- D. Utility Severance Certificates: Provide certificates, issued by the utility owners, of severance of utility services for record purposes.
- E. Private Property Owner's Release: If material demolished and removed from the site will be deposited on private property, submit two copies of written releases not more than 15 days before the start of work. Releases shall absolve the District from responsibility in

connection with the depositing of material on private property, and shall be signed by the owners of such property on which the material will be deposited.

- F. Record Documents: Provide copies of all approved submittals, specified herein, for record purposes in accordance with the requirements of Section 01 78 39 - Project Record Documents.

1.09 SITE CONDITIONS

- A. Protection of Persons and Property: Erect and maintain temporary bracing, shoring, lights, barricades, baffles, curtains, signs, and other measures as necessary to protect the public, workers, and adjoining property from damage from demolition work, all in accordance with applicable codes and regulations. Conform also with applicable requirements of Section 01 57 00 - Temporary Controls.
- B. Protection of Utilities:
1. Protect active sewer, water, gas, electric, and other utilities; and drainage and irrigation lines indicated or, when not indicated, found or otherwise made known to the Contractor before or during demolition work. If utility is damaged, immediately notify the utility owner for corrective action.
 2. Arrange with and perform work required by utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.
- C. Noise and Dust Abatement: Comply with requirements specified in Section 01 57 00 - Temporary Controls, and the following:
1. Provide continuous noise and dust abatement as required to prevent disturbance and nuisance to the public and workers and to the occupants of adjacent premises and surrounding areas. Dampen or cover areas affected by demolition operations as necessary to prevent dust nuisance.
 2. When a certain level of noise is unavoidable because of the nature of the work or equipment involved, and such noise is objectionable to the occupants of adjacent premises, make arrangements with the authorities having jurisdiction to perform such work or operate such equipment at the most appropriate time periods of the day. Provide abatement measures to the extent feasible and practicable.
- D. Unknown Conditions:
1. The Contract Drawings and related documents may not represent all surface conditions at the site and adjoining areas. The known surface conditions are as indicated, and shall be compared with actual conditions before commencement of work.
 2. Existing utilities and drainage systems below grade are located from existing documents and from surface facilities such as manholes, valve boxes, area drains, and other such surface fixtures.

3. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to ensure that the service provided is not interrupted, and do not proceed with the work until written instructions are received from the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. The Contractor shall furnish all materials, tools, equipment, devices, appurtenances, facilities, and services as required for performing the selective demolition and removal work.
- B. Materials forming portions of the structure indicated to be removed shall become the Contractor's property, and the Contractor shall be responsible for their removal from the site.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Prior to starting selective demolition operations, perform a thorough inspection of the building and premises, and report to the Engineer any defects and structural weaknesses of existing construction and of improvements to remain.
- B. Examine areas affected by the Work of this Section and verify the following conditions:
 1. Disconnection of utilities as required.
 2. That utilities serving occupied portions of adjacent or surrounding facilities will not be disturbed, except as otherwise indicated.
- C. If unsatisfactory conditions exist, notify the Engineer, and do not begin demotion operations until such conditions have been corrected.

3.02 PREPARATION

- A. The limits of the site are shown on the Contract Drawings. The Contractor shall confine its operations within the site limits indicated.
- B. Lay out cutting work at the site and coordinate with related Work for which cutting is required.
- C. Review the proposed layout with the Engineer prior to performing cutting operations.

3.03 DEMOLITION

- A. Operational Procedures and Methods:

SELECTIVE STRUCTURE DEMOLITION

1. Perform demolition and removal work in accordance with the approved Selective Demolition Plan. Perform demolition work in accordance with ANSI A10.6 and the California Code of Regulations, Title 8 and Title 24, as applicable.
2. Operational procedures shall be optional with the Contractor insofar as procedures do not infringe on the approved work schedule or salvage requirements. Conduct demolition and removal work in a manner that will minimize the spread of dust and flying particles.
3. Remove items indicated for demolition within the limits of the Work and as required to complete the Work of this Contract. Do not remove anything beyond the limits of Work indicated without prior written approval of the Engineer. If in doubt whether to remove an item, obtain written approval of the Engineer prior to proceeding.
4. Remove materials carefully, to the extent indicated and as required, providing for neat and orderly junctions between existing and new materials.
5. Protect existing structures, facilities, and landscaping from damage. Items damaged as a result of demolition operations shall be repaired or replaced, as required, at no increase in the Contract Price.
6. Perform work so as to provide the least interference and most protection to existing facilities and improvements to remain.
7. Demolish concrete and masonry in small sections. Perform demolition with small tools as much as possible. Blasting will not be permitted.

B. Jackhammering:

1. Jackhammering will be permitted only to a limited degree with prior approval of the Engineer.
2. Do not jackhammer within 2 inches of reinforcing or structural steel to remain. Remove final 2 inches of material with a chipping gun.

3.04 CUTTING

- A. Cut new openings neat, as close as possible to profiles indicated.
- B. Do not cut or alter structural members without the prior written approval of the Engineer.
- C. Remove concrete and masonry whenever possible by saw cutting or similar approved method.

3.05 SALVAGING

- A. Certain items, as indicated, shall be salvaged and reused in the Work or delivered to a District storage facility as directed.
- B. Where salvaging is required, procedures shall be such that the maximum amount of salvage will result.

- C. Coordinate the Work of this section closely with the Work of other sections of these Specifications requiring salvage and reuse of materials.
- D. Refer to other Divisions for mechanical and electrical equipment removal and salvage requirements.

3.06 INITIAL BUILDING CLEANING

- A. After demolition operations are completed, or along with demolition operations, as appropriate, clean the entire buildings and site of all dirt and dust, cobwebs, oil and grease, stains of asphalt and paint, and the various encrustations.
- B. Ceilings, walls, and floors shall be dusted and wiped clean with brooms and cloths or other suitable methods as required to clean all surfaces free of dirt and dust.
- C. Use suitable cleaning fluids or solvents, steel wool, blow-torch burning, scraping, and power sanding as required to remove the various encrustations and stains, including asphalt.
- D. Broom clean the entire building and site immediately after demolition is complete. Provide a clean and orderly site in accordance with applicable requirements of Section 01 74 14 - Cleaning.

3.07 DISPOSAL OF DEBRIS

- A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.
- B. Burying of trash and debris on the site will not be permitted. Burning of trash and debris at the site will not be permitted.
- C. Remove trash and debris from the site at frequent intervals so that their presence will not delay the progress of the work.
- D. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the District's property and disposed of in a legal manner. Location of disposal site and length of haul shall be the Contractor's responsibility.

3.08 RESTORATION OF EXISTING STRUCTURES AND FACILITIES

- A. All damage to existing structures and facilities, which are to remain in place, shall be repaired to a condition equal to that existing prior to the beginning of demolition and removal operations. The cost of repairing existing structures and facilities damaged by the Contractor's operations shall be at the Contractor's expense.

3.09 FIELD QUALITY CONTROL

- A. Following performance of the Work, perform an inspection of the premises and report defects and structural weaknesses of structures partially demolished, cut, or removed; of adjacent structures; and of improvements remaining.

- B. The Engineer will accompany the Contractor before and after performance of the Work to confirm the physical condition of the structures and improvements involved.

END OF SECTION 02 41 19

BART Facilities Standards (BFS)

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5.3 Division 3

Concrete

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SECTION 03 01 08

CONCRETE RESTORATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cutting and chipping.
- B. Repairing of cracks.
- C. Restoration work.
- D. Removal of paint.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Repair and restoration of existing concrete work will be measured for payment by the lump-sum method, acceptably performed and completed.
- B. Payment: Repair and restoration of existing concrete work will be paid for at the indicated Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.03 RELATED SECTIONS

- A. Coordinate the Work of this Section with the Work of other Sections specifying remedial work, corrective measures, and restoration work, including Section 01 71 23 - Field Engineering, Section 01 74 14 - Cleaning, and Section 02 41 19 - Selective Structure Demolition.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C881 Specification for Epoxy-Resin-Base Bonding System for Concrete
 - 2. ASTM C928 Specification for Packaged, Dry Rapid-Hardening Cementitious Materials for Concrete Repairs
 - 3. ASTM C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements which govern the work of this Section include the following code requirements:
 - 1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 34, "Existing Structures."

1.06 DESCRIPTION

- A. The station or building involved in this work will be in continuous operation during the construction period. This will require that the Contractor plan the Work carefully to work around unavoidable obstacles in the prosecution of the Work. It will require further that the Contractor complete some new construction facilities required in the renovation work before proceeding with the concrete restoration work.
- B. Provide such additional temporary facilities as may be required to facilitate continuous, unobstructed station or building operations during transitional construction work.

1.07 QUALITY ASSURANCE

- A. Repair and restoration of existing concrete surfaces shall be performed by a skilled and experienced subcontractor specializing in the restoration of concrete with at least five years experience in the type of work involved.
- B. Repair and restoration of existing concrete work shall achieve security, strength, and weather protection, as applicable and required, and shall preserve the integrity and continuity of fire-rated assemblies.
- C. Repair and restoration of existing concrete work shall successfully duplicate undisturbed adjacent finishes, colors, textures, and profiles. Where there is a dispute as to whether or not duplication is successful or has been achieved to a reasonable degree, the Engineer's judgment shall be final.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. Requirements: Provide all materials, equipment, tools, appurtenances, facilities, and services as required for performing and completing all repair and restoration of existing concrete as indicated.
- B. Equipment, Tools, and Materials: Provide appropriate and proper equipment, tools, and materials for the chipping and air-pressure cleaning of cracks in concrete, for pressure injection grouting of cracks in concrete, for sandblasting or water-blasting of concrete surfaces, and for hose cleaning of concrete.
- C. Concrete Bonding Agent: Adhesive for the bonding of new mortar and grout to existing concrete shall be an epoxy adhesive meeting requirement of ASTM C881, of type required for the conditions.
- D. Mortar and Cementitious Repair Materials:
 - 1. Mortar: Mortar shall be an epoxy mortar, polymer-fortified mortar, or similar high-strength bonding mortar conforming with ASTM C928. Minimum compressive strength at 28 days shall be 4,000 psi.

- 2. Sand: Sand shall be a clean, washed, kiln-dried, fine sand, all passing a U.S. Standard No. 16 sieve.
- E. Grout: Grout for pressure-injection grouting shall be a high-strength, nonshrink, cementitious, adhesive grout conforming with ASTM C1107, Grade C, or a high-strength, nonshrink, manufactured epoxy adhesive grout. Minimum compressive strength at 28 days shall be 5,000 psi.
- F. Cleaning Agent: Mild solution of hydrochloric acid or muriatic acid, for washing of stubborn stains on concrete.
- G. Paint: Paint for touchup work shall be an exterior acrylic-latex masonry paint, flat texture, color as required to match adjacent surfaces.

PART 3 - EXECUTION

3.01 REQUIREMENTS

- A. Perform cutting, chipping, patching/restoring work, and cleaning in a manner to prevent damage to other work, and as required to return exterior building surfaces to essentially their original condition and configuration.
- B. Major cracks shall be repaired and filled by pressure-injection grouting. All other cracks shall be repaired in the manner most appropriate and as required for weatherproofing or waterproofing the building or structure.
- C. Do not cut or alter structural members when not indicated without prior approval of the Engineer.
- D. Finish or refinish as required to match adjacent finishes.

3.02 CUTTING AND CHIPPING

- A. Cutting and chipping work shall be neatly and accurately performed with proper tools and equipment. Cuts shall be of minimum size required for the work. Check the locations carefully of existing concrete reinforcement before cutting or chipping.
- B. Pachometer readings shall be taken by the Contractor's employed testing laboratory to locate reinforcing steel in existing concrete to be cut or chipped.
- C. Existing work to remain shall be properly protected to prevent damage from cutting and chipping operations.

3.03 REPAIRING OF CRACKS

- A. Cracks shall be repaired and filled with grout by the pressure-injection process. Concrete cracks shall be mapped, and the injection shall be on center-to-center spacing as necessary to achieve proper structural bonding.

- B. Adhesive material shall be mixed with grout in proportion necessary to provide structural bonding of concrete. Grout material shall be inserted into cracks by pressure-injection grouting in accordance with the manufacturer's installation instructions and recommendations.
- C. Minor cracks too small for injection grouting shall be repaired as specified in Article 3.04 for restoration work.
- D. Small holes, cracks, and other imperfections to be painted shall be suitably primed and patched with a compound recommended by the manufacturer of the paint to be applied to these surfaces as specified in Section 09 91 00 - Painting.

3.04 RESTORATION WORK

- A. Preparation of Existing Surfaces: Where concrete is cracked or spalled, cut or chip out to solid surface. Use power wire brush and high pressure air to clean concrete of dirt, dust, and loose particles. Clean exposed reinforcing bars with power wire brushing to remove all visible corrosion.
- B. Repairing of Concrete:
 1. Repairing and patching of existing concrete work shall be expertly performed with specified adhesive, mortar, and grout materials. At completion, patched surfaces shall match adjacent existing surfaces as closely as possible.
 2. Concrete bonding agent, mortar, and grout shall be applied or installed where indicated, or where otherwise required, in accordance with the manufacturer's instructions and recommendations.
 3. Where necessary to build out cut, spalled, or chipped concrete surfaces, mix concrete bonding agent, mortar, and sand into a special mortar, and apply in layers as required to fill out or build up surfaces. Float, trowel, or texture surfaces to match adjacent existing surfaces.

3.05 REMOVAL OF PAINT

- A. Where removal of existing paint film is required for restoration of concrete surfaces, existing painted concrete and stucco surfaces shall be sandblasted by the "wet" sandblast method to remove all such paint film. Surfaces not to be sandblasted shall be properly masked and otherwise protected to preclude any damage to these surfaces.
- B. Wet sandblasted surfaces shall be thoroughly dry or dried before painting as specified in Section 09 91 00 - Painting.

3.06 CLEANING

- A. Where existing concrete surfaces are indicated to be cleaned or washed to remove dirt, dust, and stains, such surfaces shall be washed clean to an even and uniform effect, free of stains and blemishes. Include adjacent cornices, ledges, and masonry ornaments. Method of

CONCRETE RESTORATION

cleaning (e.g. high-pressure water, steam cleaning, or diluted acid cleaning) are subject to approval by the Engineer.

- B. All adjacent glass areas shall be cleaned after washing of concrete surfaces.
- C. Replace any glass damaged by the cleaning operations.

END OF SECTION 03 01 08

BART Facilities Standards (BFS)

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SECTION 03 05 15

PORTLAND CEMENT CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Portland cement.
- B. Aggregates.
- C. Drying shrinkage of concrete.
- D. Concrete admixtures and cementitious materials.
- E. Tests and analysis of materials.
- F. Mix designs.
- G. Batching, mixing, and transporting.
- H. Inspection and Testing.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Portland cement concrete will not be measured separately for payment. It will be measured in accordance with the Sections specifying construction requiring concrete.
- B. Payment: Portland cement concrete will be paid for as part of the indicated Contract unit prices or lump-sum prices for the associated concrete work as indicated in the Bid Schedule of the Bid Form.

1.03 CLASSES OF CONCRETE

- A. Classes of concrete are designated by numerical symbol indicating the minimum 28-day compressive strength, in pounds per square inch as determined by ASTM C39, and the maximum permissible size of coarse aggregate.
- B. Each class of concrete may consist of one or more mixes determined by the maximum size of aggregate, cement factor, and types of admixtures or special aggregates used.
- C. Each mix within a Class shall be considered a specific type, requiring acceptance of the mix design.
- D. The various classes of concrete are listed in Table 03 05 15-A at the end of this Section.

1.04 DEFINITIONS

- A. The word "concrete" followed only by a class designation (that is, Concrete Class 3000-1-inch) indicates normal weight aggregate concrete, such as concrete having a 28-day compressive strength of 3,000 psi, a maximum coarse aggregate size of 1 inch, and a minimum unit weight of 145 pounds per cubic foot (without reinforcement) at 28 days.
- B. The word "HVFAC" followed only by a class designation (that is, HVFAC 4000 – 1-inch) includes normal weight aggregate high volume fly ash concrete, such as HVFAC having a 56-day compressive strength of 4,000 psi, a maximum coarse aggregate size of 1 inch, with a minimum unit weight of 145 pounds per cubic foot (without reinforcement).
- C. The term "lightweight concrete" indicates lightweight structural concrete which has a maximum unit weight of 115 pounds per cubic foot at 28 days.
- D. The term "fill concrete" indicates a concrete containing sufficient cement to develop a 28-day compressive strength of 2500 psi.
- E. The term "lean concrete" indicates a concrete containing the equivalent of two 94-pound sacks of cement per cubic yard.
- F. The term "controlled density fill" indicates a flow-able mixture of aggregate and cementitious materials containing sufficient cement to develop a 28-day compressive strength of 50 to 150 psi.
- G. The term "mass concrete" indicates any volume of concrete with dimensions large enough to require that measures be taken to cope with the generation of heat from hydration of the cement and attendant volume change in order to minimize shrinkage and cracking.
- H. The term "high volume fly ash concrete" (HVFAC) indicates concrete using a mix that replaces 25 percent or more of weight of Portland cement with specified fly ash.
- I. Except for the foregoing definitions, the words and terms used in these Specifications conform to the definitions given in ACI 116R.

1.05 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 116R Cement and Concrete Terminology

PORTLAND CEMENT CONCRETE

2. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. ACI 211.2 Standard Practice for Selecting Proportions for Structural Lightweight Concrete
4. ACI 301 Standard Specifications for Structural Concrete
5. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete
6. ACI 304.2R Placing Concrete by Pumping Methods
7. ACI 305R Hot Weather Concreting
8. ACI 306.1 Standard Specification for Cold Weather Concreting
9. ACI 318 Building Code Requirements for Structural Concrete

B. American Society for Testing and Materials (ASTM):

1. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. ASTM C33 Specification for Concrete Aggregates
3. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C40 Test Method for Organic Impurities in Fine Aggregates for Concrete
5. ASTM C42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
6. ASTM C88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
7. ASTM C94 Specification for Ready-Mixed Concrete
8. ASTM C114 Test Methods for Chemical Analysis of Hydraulic Cement
9. ASTM C117 Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
10. ASTM C123 Test Method for Lightweight Particles in Aggregate

PORTLAND CEMENT CONCRETE

11. ASTM C127 Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
12. ASTM C128 Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
13. ASTM C131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
14. ASTM C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
15. ASTM C142 Test Method for Clay Lumps and Friable Particles in Aggregates
16. ASTM C143 Test Method for Slump of Hydraulic Cement Concrete
17. ASTM C150 Specification for Portland Cement
18. ASTM C157 Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
19. ASTM C172 Standard Practice for Sampling Freshly Mixed Concrete
20. ASTM C289 Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
21. ASTM C330 Specification for Lightweight Aggregates for Structural Concrete
22. ASTM C470 Specification for Molds for Forming Concrete Test Cylinders Vertically
23. ASTM C490 Standard Practice for Use of Apparatus for the Determination of Length Change of Hardened Cement Paste, Mortar, and Concrete
24. ASTM C494 Specification for Chemical Admixtures for Concrete
25. ASTM C535 Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
26. ASTM C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
27. ASTM C979 Specification for Pigments for Integrally Colored Concrete
28. ASTM C1017 Specification for Chemical Admixtures for Use in Producing Flowing Concrete

29. ASTM E329 Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.06 DESCRIPTION

- A. Portland cement concrete shall be composed of portland cement, fine aggregate, coarse aggregate, and water, with or without admixtures as approved by the Engineer, proportioned and mixed as specified herein.

1.07 SUBMITTALS

- A. General: Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Concrete Mix Designs: Submit mix designs as herein specified in Article 2.03. Include laboratory test reports of trial strength and shrinkage tests.
1. Submit HVFAC concrete mix designs and laboratory test reports of trial strength and shrinkage tests, including data at 56 days, at least 10 working days before placing concrete.
- C. Product Data: Submit manufacturer's product data for proposed concrete admixtures.
- D. Samples: Furnish and deliver samples of cement and aggregates as selected by the Engineer for testing and analysis, and additional samples to the District for information. This requirement may be waived if certificates of compliance are furnished as specified in following Article 1.05E. and Article 2.02.
- E. Affidavits/Certificates: For each shipment of materials, submit evidence of compliance with Specification requirements for cement, aggregate, and admixtures. Mill tests and manufacturers' certification of compliance with ASTM Specifications will be accepted in lieu of testing of cement and analysis of aggregates. Certificates of Compliance shall be signed by the materials manufacturer and the Contractor.
- F. Batch Tickets: Submit a delivery ticket with each batch of concrete delivered to the site in accordance with the requirements of ASTM C94.
- G. Quality Control Program: Submit quality program meeting requirements of Article 1.06C. herein.
- H. Submit for the Engineer's approval the name, address, and telephone number of the laboratory, agency, mill, or ready-mix plant which the Contractor intends to engage to design the concrete mixes.

- I. Submit for the Engineer's approval the name and qualifications of the proposed concrete technologist.

1.08 QUALITY ASSURANCE AND CONTROL

- A. The Contractor shall select a qualified concrete supplier capable of meeting project requirements and the requirements of these Specifications.
- B. The concrete supplier shall be certified by the National Ready Mix Concrete Association and shall hold a valid certificate of conformance for concrete production facilities.
- C. In conformance with applicable requirements of Section 01 45 00, Quality Control, the Contractor shall provide a quality control plan to assure control and uniformity of materials, conformance with accepted mix designs, and prompt and proper delivery of concrete to the jobsite in accordance with applicable requirements of ASTM C94. Include in the plan all tests the Contractor will perform to verify compliance with Specification requirements, and the independent laboratory the Contractor intends to engage to perform the tests.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Hot Weather Concreting:
 - 1. Batching, mixing, and delivering of concrete in hot weather shall conform to the applicable requirements of ACI 305R.
 - 2. Maximum ambient temperature for placing concrete shall be 90 degrees F. If the ambient temperature exceeds 90 degrees F, the mix shall be cooled by an appropriate method approved by the Engineer, such as icing the mixing water. Maintain uniform concrete temperature of succeeding batches placed.
- B. Cold Weather Concreting:
 - 1. Batching, mixing, and delivering of concrete in cold weather shall conform to the applicable requirements of ACI 306.1.
 - 2. When the ambient temperature drops below 35 degrees F, or is expected to drop below 35 degrees F during placement, the temperature of the mix shall be heated by adding hot water, not exceeding 120 degrees F, or by steam heating the aggregates, or both. Other methods of heating aggregates will not be permitted. Steam heating the aggregates may require an adjustment in the mixing water.
 - 3. All concrete shall be protected against freezing for at least 36 hours after placing.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150, Type II, low alkali. Type III portland cement may be used where high early strength concrete is a requirement as approved by the Engineer.

B. Aggregates:

1. Coarse Aggregate: ASTM C33, clean and uniformly graded from 3/8 inch to maximum size indicated or specified. When not specified, provide 1 inch maximum size (ASTM C33, Size No. 57). Deleterious materials in aggregates shall not exceed the limits specified in ASTM C33.
2. Fine Aggregate: ASTM C33, uniformly graded from 3/8-inch to fines, washed clean. Deleterious materials in fine aggregates shall not exceed the limits specified in ASTM C33.
3. Lightweight Aggregates: ASTM C330, uniformly graded to maximum size indicated or specified. When not specified, provide 3/4-inch to No. 4 coarse aggregate combined with ASTM C33 graded fine aggregate.
4. Aggregate for Exposed Concrete: Aggregate for concrete which will be exposed to the public shall be obtained from one source for each type of aggregate required in order to produce a uniform color.

C. Special Aggregates for Reducing Shrinkage and Creep: Cast-in-place reinforced concrete used for underground structures critical to continued main line track operations, concrete for post-tensioned cast-in-place concrete and for precast, prestressed concrete, and for topping slabs shall be produced with special aggregates conforming to the following requirements:

1. Source of Aggregates: Aggregates shall be obtained from a selected aggregate source, known to produce aggregates complying with the specified requirements, as approved by the Engineer.
2. Coarse Aggregate:
 - a. Coarse aggregate shall consist of hard, dense, durable crushed or uncrushed gravel or crushed aggregate conforming to ASTM C33 and the herein specified requirements. Deleterious substances in aggregates shall not exceed the following limits:

<u>Deleterious Material</u>	<u>Percent By Weight</u>
1) Material Passing No. 200 Sieve (ASTM C117):	
a) Nominal size range No. 4 to 3/4 inch:	0.5

- b) Nominal size range 3/4 inch to 1-1/2 inch: 0.4
 - 2) Shale (ASTM C123, specific gravity of heavy liquid 1.95): 1.0
 - 3) Clay lumps (ASTM C142): 0.5
 - 4) Other deleterious substances: 1.0
 - 5) Total of all deleterious substances: 3.0
- b. Coarse aggregate shall conform to the following requirements when tested in accordance with the specified ASTM Test Methods:
- 1) Resistance to Abrasion (ASTM C131): The loss for aggregate size range 3/4 inch to 3/16 inch after 100 revolutions and 500 revolutions shall not exceed 10 percent and 40 percent, respectively. The test sample shall consist of 7 parts of grading B and 3 parts of grading C.
 - 2) Resistance to Abrasion (ASTM C535): The loss for aggregate size range 1-1/2 inch to 3/4 inch (grading 3) after 200 revolutions and 1000 revolutions shall not exceed 10 percent and 40 percent, respectively.
 - 3) Soundness (ASTM C88): Weighted average loss after 5 cycles shall not exceed 12 percent when tested with sodium sulfate.
 - 4) Specific Gravity (ASTM C127): Bulk specific gravity on the basis of saturated surface-dry aggregate shall be not less than 2.60.
 - 5) Absorption (ASTM C127): Absorption shall not exceed 3 percent.
 - 6) Potential Reactivity (ASTM C33): Only aggregates considered innocuous in accordance with Appendix XI shall be used in the work.

3. Fine Aggregate:

- a. Fine aggregate shall consist of hard, dense, durable, stone or rock fragments conforming to ASTM C33 and the herein specified requirements. Deleterious substances in aggregate shall not exceed the following:

<u>Deleterious Material</u>	<u>Percent By Weight</u>
1) Material passing No. 200 sieve (ASTM C117):	3.0
2) Shale (ASTM C123, specific gravity of heavy liquid 1.95):	1.0

- 3) Clay lumps (ASTM C142): 1.0
 - 4) Total of other deleterious substances,
(such as alkali, mica, coated grains,
soft flaky particles, and loam): 2.0
 - 5) Total of all deleterious substances: 5.0
- b. Fine aggregate shall conform to the following requirements when tested in accordance with the specified ASTM Test Methods:
- 1) Specific Gravity (ASTM C128): Not less than 2.60 on a saturated surface-dry basis.
 - 2) Organic Impurities (ASTM C40): Supernatant liquid must be lighter in color than the reference standard color solution.
 - 3) Soundness (ASTM C88): Loss in 5 cycles of sodium sulfate test shall not exceed 12 percent.
 - 4) Potential Reactivity (ASTM C289): Only fine aggregate considered innocuous shall be used in the work.
 - 5) Fineness Modulus (ASTM C33): Fineness modulus shall be in the range of 2.30 to 3.00, however, the variation of the fineness modulus shall not exceed 0.20.
4. Drying Shrinkage of Concrete:
- a. A trial batch of the proposed (mix design) concrete shall be prepared using the aggregates, cement, and admixture proposed for this work. From the trial batch, three specimens (4 inches by 4 inches by 11 inches) for determining "Drying Shrinkage" shall be prepared, cured, dried, and measured as specified in ASTM C157 and ASTM C490, with the following modifications:
 - 1) Cast-in-place concrete shall be moist cured for 10 days.
 - 2) Precast, prestressed concrete shall be steam cured for 1 day.
 - 3) Measurements shall be made and reported for 7, 14, 21, and 28 days of drying after 9 days of moist curing and 1 day of steam curing. Measurements for HFVAC shall also be made and reported for 56 days of drying.

- b. Shrinkage of specimens for cast-in-place concrete shall not exceed 0.040 percent when measured in accordance with ASTM C157 and ASTM C490 after 21 days of drying.
 - c. Shrinkage of specimens for prestressed concrete shall not exceed 0.035 percent when measured in accordance with ASTM C157 and ASTM C490 after 21 days of drying.
 - d. Shrinkage of HVFAC specimens shall not exceed 0.055 percent when measured in accordance with ASTM C157 after 28 days drying including minimum 7 days moist cure.
- D. Concrete Admixtures and Cementitious Materials: The Contractor may include accepted concrete admixtures and cementitious materials in the mix to improve the water-cement ratio or water-cementitious ratio or workability of the concrete, providing the strengths specified and other desirable characteristics of the concrete can be achieved and maintained. Admixtures require the Engineer's acceptance before they may be used, and shall be included in the design mix, introduced in solution form. Admixtures shall be added at the batch plant, except as otherwise noted herein.
- 1. Chemical Admixtures, Water-Reducing: ASTM C494, Type A.
 - 2. Pozzolanic Admixtures: ASTM C618, Class N or F.
 - 3. Fly Ash: ASTM C618, Class F, with a maximum of 25 percent retained on the No. 325 mesh sieve and a loss on ignition of 1.0 percent maximum.
 - 4. Pigments for integrally colored concrete: ASTM C979, for synthetic or natural iron oxides (red).
 - 5. Chemical Admixtures, Plasticizing: ASTM C1017, or ASTM C494 Type F or Type G, high-range water-reducing admixtures.
 - 6. Prohibited Admixtures: Admixtures containing chlorides or sulfides are not acceptable.
- E. Water: Water for concrete mixes, curing, and cleaning shall be clean and potable, free of impurities detrimental to concrete.
- F. Reinforcement Fibers: Chopped strands of alkali-resistant polypropylene fibers added to the concrete mix for protection against shrinkage cracks where indicated or required.

2.02 TESTS AND ANALYSES OF MATERIALS

- A. Tests and Sample Analyses: Testing of cement and analysis of aggregates shall be performed by the Contractor as specified herein. Mill tests and supplier's certification of

compliance with ASTM Specifications will be accepted in lieu of testing of cement and analysis of aggregates. Tests and services shall consist of the following:

1. Testing of portland cement in accordance with ASTM C150 and ASTM C114.
 2. Analysis of aggregates in accordance with ASTM C33, and sieve analysis of fine and coarse aggregates in accordance with ASTM C136.
 3. Tests of special aggregates for reducing shrinkage and creep shall conform to the requirements herein specified under Article 2.01C.
- B. Samples: Furnish and deliver identified samples of materials required for tests and analysis in the amounts required by the Contractor's employed independent testing laboratory without charge. Samples shall be selected at random by the testing laboratory. Deliver samples of cement and aggregates at least 30 days prior to use on the project.

2.03 MIX DESIGNS

- A. Design of concrete mixes, including recommended amounts of admixture and water to be used in the mixes, shall be obtained by the Contractor from a qualified independent testing laboratory or agency, or from a mill or ready-mix plant, properly equipped to design concrete mixes. The design shall be performed and certified by a professional engineer currently registered as a civil or structural engineer in the State of California. The laboratory, agency, mill, or ready-mix plant shall meet applicable requirements of ASTM E329, and shall be approved by the Engineer. Costs of obtaining the mix designs shall be paid by the Contractor.
1. In addition to the requirements specified above, concrete mix designs for HVFAC shall be performed by a concrete technologist with documented experience in the design of HVFAC.
- B. Selection of mix proportions shall conform to the applicable requirements of ACI 211.1 and ACI 211.2. Concrete shall comply with ACI 301 and ACI 318, as applicable. Ensure that mix designs will produce concrete suited for proper placement and finishing.
- C. Mix design for HVFAC shall include replacement of 25 to 50 percent of Portland cement by weight with fly ash.
- D. Mix design for subway structures and below-grade retaining walls for stations and other facilities shall include 15 percent replacement of the cement with fly ash, along with a plasticizing admixture conforming with ASTM C1017, to provide a dense and plastic concrete with low shrinkage and permeability characteristics.

- E. Mix design for architectural concrete and formed concrete which will be exposed to the public in the finished work shall include 10 percent replacement of the cement with fly ash along with a plasticizing admixture, conforming with ASTM C1017, to provide a dense and plastic concrete mix which completely fills out the forms and form detail without air holes and rock pockets.
- F. Mix designs shall indicate brands, types, and quantities of admixtures included. If fly ash is proposed, it shall be identified as such (for example, "fly ash"), and the mix design shall identify the percentage of cement replacement and the locations in the structures where such mixes are proposed for use.
- G. Mix designs for integrally colored concrete shall indicate brand type of natural or synthetic metallic oxide or pigment, and quantity used, all prepared as specified in ASTM C979. Compensate for fly ash with additional pigment as applicable. Concrete encasements of below-grade electrical conduits and ductbanks containing circuits over 600 Volts shall be integrally colored red concrete.
- H. Mix design for mass concrete shall have a percentage of fly ash replacement of cement by weight to reduce the amount of heat generated during heat of hydration. Amount of fly ash to be introduced into the mix shall be approved by the Engineer. ASTM C494 Type F or Type G high-range water-reducing admixture may also be used to reduce heat of hydration.
- I. If concrete is to be placed by pumping, concrete mixes shall be designed in accordance with the applicable requirements of ACI 304R and ACI 304.2R, and shall include strengths and slumps.
- J. Mix design for controlled density fill (controlled low strength material) to be used for structural backfill for utility trenches and pipe culverts shall contain approximately 20 to 30 pounds of cement per cubic yard along with fly ash in amount required to provide a workable mixture. The 28-day compressive strength shall be not less than 50 psi or more than 150 psi. Soil or aggregate component shall be an inert material without organic matter, all passing a 1-inch sieve.
- K. Mix designs shall indicate location of each mix within the structure. Mix designs shall specify both coarse and fine aggregate sources.
- L. Upon receipt of acceptable mix designs from the prequalified testing laboratory or agency or concrete supplier, conforming with specified requirements, the Contractor shall submit these accepted mix designs to the Engineer for review, 10 days prior to batching or delivering any concrete.
- M. Concrete mixes shall contain the minimum number of 94-pound sacks of cement per cubic yard specified in Table 03305-A, regardless of the fact that the strengths specified may be obtained with lesser amounts of cement. Exception will be made only for mass concrete to reduce heat of hydration as hereinbefore specified.

- N. The water-to-cement ratio shall not exceed 0.40 for concrete which may be exposed to underground water, such as subway and station structures and for concrete in structures critical to continued main line track operations. Conversion to equivalent water-to-cementitious ratio shall be performed in accordance with applicable requirements of ACI 211.1.
- O. Concrete for duct banks shall have a 28-day compressive strength of 3,000 psi, minimum.

2.04 BATCHING, MIXING, AND TRANSPORTING

- A. Batching, mixing, and transporting portland-cement concrete shall conform to the applicable requirements of ACI 301 and ACI 304R.
- B. Concrete shall be central-mixed concrete from a central batch plant, to be transported to the jobsite in a truck mixer, in accordance with the requirements of ASTM C94. Equipment used in the manufacture of concrete shall be kept clean at all times.
- C. Mixers shall be equipped with automatic device for recording number of revolutions of drum prior to completion of mixing operation. Each transit mixer shall also be equipped with water measuring devices consisting of either accurately calibrated water tanks or water meters.
- D. Concrete in truck mixer shall be mixed continuously until discharged. The discharge time for concrete after the introduction of mixing water shall not exceed 60 minutes. The discharge time for concrete after cement has been mixed with aggregate shall not exceed 90 minutes. Delivery tickets shall show departure time from plants.
- E. Ready-mixed concrete shall be mixed for a period of not less than 10 minutes and at least 3 minutes of the mixing period shall be immediately prior to discharging at the job. The introduction of additional water into transit type mixers after leaving the plant will not be permitted.
 - 1. If adjustment of HVFAC slump in field is necessary, it may be made by addition of high range water reducing admixture within the limitations prescribed by the concrete technologist.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Inspection and Testing Services:
 - 1. Visual inspections and acceptance of concrete mix designs will be by the Engineer. The Engineer will observe concrete batching, mixing, and placing

operations, and the Contractor shall keep records of all concrete placed. Copies of such records shall be submitted to the Engineer for record purposes.

2. Testing services for the Contractor's quality control program, including concrete strength tests, shall be provided by an independent testing laboratory or agency, employed by the Contractor and approved by the Engineer, and shall be performed in accordance with the applicable requirements of ACI 301. If, as a result of these tests, it is determined that the specified concrete properties are not being obtained, the Engineer will order such changes in proportions or materials, or both, as may be necessary to secure the specified properties.
 - a. Field tests shall be performed by personnel having ACI Level 1 Field Technician Certification.
3. Failure of the Engineer to detect defective work or material shall not prevent later rejection when such defect is discovered, nor shall it obligate the Engineer for final acceptance.
4. Additional inspection and testing services required by the Engineer because of changes in materials, sources, or proportions; or occasioned by failure of inspections and tests to meet specification requirements, shall be paid for by the Contractor.
5. Provide materials, labor, and services for sampling and testing of concrete, including the following facilities and services:
 - a. Preparation, handling, storage, and delivery of concrete test specimens.
 - b. Suitable containers for the storage, curing, and delivery of concrete test specimens in accordance with ASTM C31 and ASTM C470.
 - c. Suitable storage for a supply of test cylinder molds, test specimens to be cured at the jobsite, and other items required for sampling and testing.

B. Methods of Sampling and Testing:

1. **Sampling:** Representative composite samples shall be taken by the Contractor in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis.
2. **Slump Tests:** The above-specified Contractor-employed testing laboratory shall perform slump tests of concrete during placing of concrete, as required, in accordance with ASTM C143. At least one test shall be performed at the delivery trucks for each 50 cubic yards of concrete delivered.

3. Tests for Concrete Uniformity: The same testing laboratory shall perform tests for concrete uniformity in accordance with ASTM C94, Annex A1. Each batch of concrete shall be tested as specified in ASTM C94, Annex A1.
4. Tests for Concrete Temperature: Freshly mixed concrete shall be tested hourly when the ambient temperature is below 40 degrees F and above 80 degrees F, and each time compression test cylinders are made. The concrete temperature shall be recorded on all compression test cylinders made. Refer to Article 1.07 herein for hot and cold weather remedial requirements.
5. Strength Tests:
 - a. The Contractor shall prepare, cast, and deliver to the same independent testing laboratory, cylinders for laboratory-cured compression test samples. Cylinders shall be made and cured in accordance with ASTM C31. Cylinders shall be tested in accordance with ASTM C39.
 - b. The minimum number of test cylinders to be made for each class of concrete and for each placement shall be four cylinders for each 100 cubic yards or fraction thereof. When additional sets of test cylinders are required beyond the normal seven and 28-day tests, each set shall consist of a minimum of two test cylinders.
 - c. All cylinders in a set shall be marked with a unique number on one end. The Contractor shall record this number on the record of concrete placed. All cylinders shall be cured by the Contractor's independent testing laboratory.
 - d. From each set of cylinders cast, one cylinder shall be tested at seven days and two cylinders at 28 days in accordance with ASTM C39. If the 28-day tests are satisfactory, the fourth cylinder shall be discarded.
 - e. In the event the 28-day tests are below the specified strength requirements, the Laboratory shall then test the fourth cylinder at the age selected by the Engineer.
6. Strength Tests for HVFAC: In addition to the strength test requirements specified above the following provisions apply to HVFAC:
 - a. The minimum number of test cylinder to be made for HVFAC for each class and for each placement shall be six laboratory cured cylinders for each 100 cubic yards or fraction thereof.
 - b. When the ambient air temperature at time of placement of HVFAC is less than 50 degrees F, four additional cylinders shall be taken hourly and tested.

c. From each set of HVFAC laboratory cured cylinders cast, two each shall be tested at seven, 28, and 56 days.

7. Tests for Contractor's Benefit: Tests required to verify early form removal, or other reasons for the Contractor's benefit, shall be performed at Contractor's expense as part of the Contractor's quality control program.

C. Evaluation and Acceptance of Tests:

1. Acceptance of Concrete: The strength of the concrete shall be considered satisfactory, provided the averages of all sets of three consecutive strength test results equal or exceed the specified 28-day compressive strength, and no individual strength test result falls below the specified 28-day compressive strength by more than 500 psi.

a. Acceptance of HVFAC: The strength of HVFAC shall be considered satisfactory, provided the averages of all sets of three consecutive strength test results equal or exceed the specified 56-day compressive strength, and no individual strength test result falls below the specified 56-day compressive strength by more than 500 psi.

2. Adjustments: The Contractor's independent testing laboratory shall order adjustments to the mix proportions, increase in the minimum cement content, additional curing of the structure, or any combination of the above when strength tests acceptance criteria specified are not being met.

3. Test Cores:

a. When laboratory test results indicate concrete to be more than 300 psi below the specified strength, or if there is a likelihood of low strength concrete, a significant reduction in load-carrying capacity, or absence of desired durability in the concrete, the Engineer will require tests of cores to be drilled from the areas in question.

b. Test cores shall be obtained from each member or area of suspect strength, from locations designated by the Engineer, and test specimens shall be prepared by the Contractor in accordance with ASTM C42.

c. Three cores shall be taken for each determination of in-place strength. Concrete in the area represented by the core tests will be considered structurally adequate if the average of the three cores is equal to at least 85 percent of the specified design strength and no single core is less than 75 percent of the design strength. Locations represented by erratic core strengths shall be retested at the direction of the Engineer.

- d. Fill core holes in accordance with the requirements of Section 03 35 00, Concrete Finishing, for repair of surface defects.
- 4. Rejection of Concrete; Repair and Replacement: The Engineer shall have authority to reject concrete work which does not meet specification requirements, and to require repair or replacement as necessary to complete the Work.
- D. Acceptance of Structure: Acceptance of the completed concrete work requires conformance with the dimensional tolerances, appearance, and strengths specified in these Specifications, in ACI 301, and in ACI 117.

3.02 SCHEDULES

TABLE 03 05 15-A
PORTLAND CEMENT CONCRETE MIXES

CLASSIFICATION		MINIMUM CEMENT CONTENT
Compressive Strength (psi) at 28 days	Maximum Aggregate Size	94-Pound Sacks per cubic yard
A. Reinforced Concrete:		
2500	3/8 inch	5.0
2500	1 inch	4.5
2500	1-1/2 inch	4.5
3000	3/8 inch	5.5
3000	1 inch	5.0
3000	1-1/2 inch	5.0
3500	3/8 inch	6.0
3500	1 inch	5.5
3500	1-1/2 inch	5.0
4000	3/8 inch	6.5
4000	1 inch	6.0
4000	1-1/2-inch	5.5
4500	3/8 inch	7.0
4500	1 inch	6.5
4500	1-1/2 inch	6.0
5000	3/8 inch	7.0
5000	1 inch	6.5
B. Prestressed Concrete:		
5000	1 inch	7.0
6000	1 inch	7.5

CLASSIFICATION		MINIMUM CEMENT CONTENT
Compressive Strength (psi) at 56 days	Maximum Aggregate Size	94-Pound Sacks per cubic yard

C. High Volume Fly Ash Concrete:

4000 ¹	1 inch	Note 2
4000 ¹	1-1/2 inch	Note 2

¹ Compressive Strength at 7 days shall be 2,000 psi, at 28 days 4,000 psi.

² Cement content and maximum water to cementitious material ratio in accordance with the recommendations of the concrete technologist as approved by the Engineer.

END OF SECTION 03 05 15

BART Facilities Standards (BFS)

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SECTION 03 05 18

PRESTRESSED CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Prestressing tendons, anchors, coatings, sheathing, couplings, sleeves and gaskets.
- B. Concrete and grout.

1.02 RELATED SECTIONS

- A. Concrete formwork is specified in Section 03 11 00 - Concrete Forming.
- B. Concrete falsework is specified in Section 03 11 14 - Falsework.
- C. Reinforcing steel for concrete (typical rebar) is specified in Section 03 20 00 - Concrete Reinforcing.
- D. Cast-in-place concrete is specified in Section 03 30 00 - Cast-In-Place Concrete.
- E. Portland-cement concrete is specified in Section 03 05 15 - Portland Cement Concrete.
- F. Finishing and curing of concrete are specified in Section 03 35 00 - Concrete Finishing, except as modified herein for precast, prestressed concrete.
- G. Requirements for precast concrete are specified in Section 03 40 00 - Precast Concrete.

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for prestressed concrete will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for prestressed concrete indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for prestressed concrete, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Price
 - 1. If the Bid Schedule indicates a unit price for prestressed concrete, the unit-price method of measurement and payment will be as follows:
 - a. Measurement:
 - 1) Cast-in-Place, Post-Tensioned, Prestressed Concrete: Concrete for prestressed concrete will be measured for payment by the cubic yard, as specified in Section 03 30 00 - Cast-In-Place Concrete, and will include prestressing steel tendons, sheathing and ducts, distribution plates,

PRESTRESSED CONCRETE

anchorage devices, grout, reinforcing steel, embedded items, and prestressing operations, as applicable.

- 2) Precast/Prestressed Concrete: Precast, prestressed concrete members will be measured for payment by the individual unit (each), erected and installed in place, multiplied by the total number of identical units installed, and will include prestressing steel tendons, sheathing ducts, distribution plates, anchorage devices, grout, reinforcing steel, embedded items, and prestressing operations, as applicable.
- b. Payment: Prestressed concrete will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.a.

1.04 REFERENCES

- A. American Concrete Institute (ACI):
1. ACI 301 Standard Specifications for Structural Concrete
 2. ACI 318 Building Code Requirements for Structural Concrete
- B. Precast/Prestressed Concrete Institute (PCI):
1. PCI MNL 116 - Manual of Quality Control for Plants and Production of Precast and Prestressed Concrete Products
 2. PCI Design Handbook – Precast and Prestressed Concrete
- C. Post-Tensioning Institute (PTI):
1. Post-Tensioning Manual

1.05 DEFINITIONS

- A. The words and terms used in these Specifications conform with the definitions given in ACI 301 and ACI 318.

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Comply with requirements of ACI 301, Section 9 – Prestressed Concrete.
- C. Preliminary Data: Comply with requirements of ACI 301 Section 9 – Prestressed Concrete.
- D. Field Data: Comply with requirements of ACI 301, Section 9 – Prestressed Concrete.

1.07 QUALITY ASSURANCE

- A. Governing Standards:
1. American Concrete Institute: ACI 301 in its entirety is hereby incorporated into these Specifications. ACI 301, Section 9 – Prestressed Concrete, and ACI 318, Chapter 18 – Prestressed Concrete, shall govern the work of this Section, as applicable.
 2. Precast/Prestressed Concrete Institute: Comply with the herein referenced PCI Manual 116 and the PCI Design Handbook – Precast and Prestressed Concrete, as applicable.
 3. Post-Tensioning Institute: Comply with the herein referenced PTI Post-Tensioning Manual, as applicable.
- B. Testing: Comply with ACI 301, Section 9 – Prestressed Concrete, for the following test requirements:
1. Test assembly;
 2. Static test;
 3. Dynamic test for unbonded tendons; and
 4. Grout testing.
- C. Tolerances: Comply with requirements of ACI 301, Section 9 – Prestressed Concrete.
- D. Precast, Prestressed Concrete: Comply with requirements of Section 03 40 00 - Precast Concrete, as applicable to the precast and erection portions of the work.

1.08 PRODUCT DELIVERY, HANDLING, AND STORAGE

- A. Comply with requirements of ACI 301, Section 9 – Prestressed Concrete.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide materials that comply with ACI 301, Section 9 – Prestressed Concrete, as follows:
1. Prestressing tendons;
 2. Coatings for unbonded tendons;
 3. Sheathing for bonded tendons;
 4. Sheathing for unbonded tendons;
 5. Anchorages for bonded tendons;
 6. Anchorages for unbonded tendons;
 7. Couplings; and
 8. Sleeves and gaskets.

2.02 DESIGN OF CONCRETE AND GROUT MIXTURES

- A. Concrete: Comply with requirements of Section 03 05 15 - Portland Cement Concrete. Provide Class 6000 concrete unless otherwise indicated. Proportion concrete mixtures in accordance with ACI 301, Section 4 – Concrete Mixtures.

- B. Grout: Comply with requirements of ACI 301, Section 9 – Prestressed Concrete.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Comply with requirements of ACI 301, Section 9 – Prestressed Concrete.

3.02 PREPARATION

- A. Comply with requirements of ACI 301, Section 9 – Prestressed Concrete, as follows:

1. Grouting; and
2. Tendons and concrete.

3.03 PLACEMENT

- A. Comply with requirements of ACI 301, Section 9 – Prestressed Concrete, as follows:

1. Tendons and accessories; and
2. Grout.

3.04 TENSIONING AND OTHER OPERATIONS INVOLVING TENDONS

- A. Comply with requirements of ACI 301, Section 9 – Prestressed Concrete, as follows:

1. Sequence;
2. Tensioning multiple;
3. Prestressing force;
4. Prestress loss;
5. Formwork;
6. Prevention of damage to tendons, and
7. Trimming of tendons.

END OF SECTION 03 05 18

SECTION 03 11 00
CONCRETE FORMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Layout of formwork.
- B. Formwork construction.
- C. Embedded items and openings in concrete.
- D. Form release materials.
- E. Removal of forms.
- F. Field quality control.
- G. Detection of movement.
- H. Re-use of forms.

1.02 RELATED SECTIONS

- A. Falsework for concrete structures is specified in Section 03 11 14 – Falsework. Coordinate formwork supported by falsework with the requirements of Section 03 11 14.
- B. Finishes for formed surfaces are specified in Section 03 35 00 - Concrete Finishing.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Concrete formwork will not be measured separately for payment.
- B. Payment: Concrete formwork will be paid for as part of the indicated Contract unit price or lump-sum price for the associated cast-in-place concrete work as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials
 - 2. ACI 301 Standard Specifications for Structural Concrete
 - 3. ACI 318 Building Code Requirements for Structural Concrete
 - 4. ACI 347 Formwork for Concrete

- B. American Plywood Association (APA):
 - 1. U.S. Product Standard PS 1 for Construction and Industrial Plywood

- C. West Coast Lumber Inspection Bureau (WCLB):

- 1. WCLB No. 17 Standard Grading Rules

1.05 QUALITY ASSURANCE

- A. Formwork Standards: Unless otherwise indicated, design, construct, erect, maintain, and remove forms and related structures for concrete work in accordance with applicable requirements of ACI 301, ACI 318, and ACI 347.

- 1. Architectural Concrete: Forms for architectural concrete shall be designed and constructed in accordance with ACI 301.
 - 2. Deflection: Where dead and live loads on forms will be more than 20 percent greater than the weight of the concrete, provide framing lumber of required strength, and comply with ACI 301 and ACI 347 for design of framing members. Deflection shall be kept within the herein specified tolerances.
 - 3. Concrete Mix Design: Design of formwork shall be coordinated with the concrete mix design, as specified in Section 03 05 15 - Portland Cement Concrete, so that form materials, form surfaces, and formwork strength will produce the desired concrete tolerances and finishes.

- B. Formwork Surface Materials: Provide material and work quality which will produce clean and uniform finished surfaces within the allowable tolerances specified and which will conform with the following requirements:

- 1. Concrete Exposed to View: Provide material and work quality that will produce clean, smooth, and uniform concrete surfaces. Refer to Section 03 35 00 - Concrete Finishing, and ACI 301 for requirements.
 - 2. Concrete Concealed from View: Provide material and work quality that will produce aligned concrete surfaces free of fins, honeycomb, and stains.

- C. Special Formwork Sections: Provide openings, offsets, sinkages, keyways, recesses, moldings, rustication strips, chamfers, blocking, screeds, bulkheads, anchorages, embedded items, and other features. Select materials and provide workmanship that will ensure indicated finishes.

- D. Chamfered Corners: All external corners shall be chamfered, unless otherwise indicated.

- E. Removal Features: Design formwork to be readily removable without impact, shock, and damage to concrete surfaces and adjacent materials.

- F. Tolerances for Formed Surfaces: For buildings and similar structures, comply with the requirements of ACI 301, as applicable. For those items of work or parts of the structure not

covered by ACI 301, comply with the requirements of ACI 117, as applicable. Coordinate with the requirements specified in Section 03 30 00 - Cast-In-Place Concrete.

1. The class of surface for offset between adjacent pieces of formwork facing material shall be Class A for surfaces permanently exposed to public view and Class C for surfaces that will be permanently concealed, unless otherwise specified.

G. **Abrupt and Gradual Irregularities Tolerances for Formed Surfaces:** In addition to the tolerance requirements of ACI 301, surfaces of buildings and similar structures permanently exposed to view shall conform to the abrupt and gradual irregularities tolerances specified herein. Abrupt irregularities shall be understood to mean offsets and fins resulting from displaced, mismatched, or misplaced forms, sheathing, or liners or from defects in forming materials are considered abrupt irregularities. Gradual irregularities shall be understood to mean those resulting from warping and similar uniform variations from planeness or true curvature. Gradual irregularities shall be checked with a straightedge for plane surfaces or a shaped template for curved or warped surfaces.

1. In measuring irregularities, the straightedge or template shall be placed in various places on the surface in various directions. Permitted abrupt or gradual irregularities in formed surfaces as measured within a 5 foot length with a straightedge shall be as follows:

Class of Surface	Maximum Abrupt or Gradual Irregularity
A	1/8 inch
B	1/4 inch
C	1/2 inch
D	1 inch

1.06 SUBMITTALS

A. **General:** Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures. For formwork submittals involving shoring or falsework, comply with requirements specified in Section 03 11 14 - Falsework.

B. **Shop Drawings:** Submit drawings that indicate and include the following details and requirements:

1. Forming system and method of erection with associated details.
2. Shoring accompanied by design calculations. Include reshoring procedures. Both drawings and calculations shall be signed by an engineer who is currently registered as a civil or structural engineer in the State of California. Coordinate with Section 03 11 14 - Falsework.
3. Locations of construction joints in plan and elevation views. Means of leakage prevention for concrete exposed to view in finished construction.
4. Locations and sizes of conduits, openings, recesses, pipes, ducts, and other attached or embedded products.

5. Beam intersections and other conditions where concrete casting by vertical drop may be restricted.
 6. Chamfer strips for corner treatment.
 7. Method and schedule for removing forms and shoring.
 8. Method for detecting formwork movement during concrete placement.
- C. Product Data: Submit manufacturers' product data for manufactured products. Include products proposed for leakage control.
- D. Samples: Submit form material, 12 inches by 12 inches or larger in size, for formed concrete which will be exposed in the finished work to public view. Such samples require approval of the Engineer before they may be used in the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Storage: Store form panels to prevent warpage. Protect panels from damage and contamination which could adversely affect concrete.
- B. Handling: Lift form panels by methods that will protect panels from damage and distortion.

1.08 JOB CONDITIONS

- A. Allow sufficient time between erection of forms and placing of concrete for the various trades to properly install concrete reinforcement, embedded items, sleeves, and blockouts.
- B. Do not apply superimposed loads to the structure until concrete has developed its specified 28-day compressive strength.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Lumber: Boards and framing lumber shall be graded and grade-marked in accordance with WCLB No. 17. Provide framing lumber of required strength, conforming with the above-specified WCLB No. 17.
1. Boards: Provide all West Coast Species, "Construction" or "Standard" Boards. Use dressed side of lumber for surface in contact with the concrete, and provide boards with dressed or tongue-and-groove edges to provide tight joints to prevent mortar leakage.
 2. Framing Lumber:
 - a. Light Framing: Provide all West Coast Species, "Construction" or "Standard" Light Framing, dressed or rough. Where loads are not a factor, "Utility" Light Framing will be acceptable.

CONCRETE FORMING

- b. Joists and Planks: Provide all West Coast Species, "No. 2" Structural Joists and Planks, dressed or rough.
 - c. Beams and Stringers: Provide all West Coast Species, "Standard" Beams and Stringers or "No. 2 Structural" Beams and Stringers, dressed or rough.
- B. Plywood (Plyform): Plywood shall be graded and grade-marked in accordance with U.S. Product Standard PS-1.
 - 1. B-B Plyform: Provide Class I, EXT-APA, sanded, APA trade marked.
 - 2. B-C Plyform: Provide Class I, EXT-APA, APA trade marked.
 - 3. High Density Overlay (HDO) Plyform: Provide A-A, 60-60, Class I, EXT-APA, APA trade marked.
 - 4. Thickness: As required to maintain surface smoothness without deflection, but not thinner than 5/8 inch.
- C. Steel Forms: Proprietary, patented, or fabricated steel forms, using standard or commercial quality, uncoated steel sheet or plate, 3/16-inch minimum thickness, for panel facings. Provide surfaces that will not impart corrosion residue to concrete. Include panel framing, reinforcement, and erection accessories.
- D. Waffle Slab Forms: Steel or reinforced plastic dome forms for two-way joist construction, smooth surface, of sizes indicated.
- E. Round Column Forms: Pressed or molded fiber-reinforced plastic or steel, manufactured round column forms, seamless or one-piece (one vertical seam), smooth surface, of sizes indicated.
 - 1. Provide forms with will not deflect under pressure of concrete placement, and which will not deflect or blow off under added pressure of placement of fly-ash-modified concrete.
- F. Formliners for Exposed and Architectural Concrete: Thermally formed, pressed or molded fiber-reinforced plastic (FRP), ABS alloy plastic, PVC alloy plastic, or similar material, manufactured to produce finished concrete of design, configuration, and surface texture indicated. Fromliners shall be continuous, one piece. No horizontal joints shall be acceptable unless the applicable height exceeds the available formliner height. Provide formliners with inherent form-release surface. Formliners may be manufactured for single-use or multi-use service as appropriate.
- G. Leakage Control Materials: Provide materials capable of producing flush, watertight, and nonabsorbent surfaces and joints, and compatible with forming material and concrete ingredients. Seal form edges with gasketing material or sealant placed in the joint in such a way that neither a fin nor groove is made in the face of the cast concrete.
- H. Form Release Agent: Commercial formulation, silicone-free form-release agent, designed for use on all types of forms, which will not bond with, stain, nor adversely affect concrete surfaces, and which will not impair subsequent treatment of concrete surfaces requiring bond or adhesion nor impede wetting of surfaces which will be cured with water, steam, or curing compounds.

- I. Plugged Cone Form Ties: Rod type, with ends or end fasteners which can be removed without spalling the concrete and which leave a hole equal in depth to the required reinforcement clearance. Form ties shall be of a design in which the hole left by the removed end or end fastener is easily filled to match the surface of the hardened concrete. Provide removable cones 1-1/4 inches in diameter by 1-1/2 inches deep. Provide preformed mortar plugs to match the color of the concrete, recessed 1/4 inch, adhered with an approved epoxy adhesive.
- J. Inserts: Cast stainless steel or welded stainless steel, Type 316 or similar 300 Series, complete with anchors to concrete and fittings such as bolts, wedges, and straps. Provide hanger inserts spaced to match grid of suspended ceiling.
- K. Dovetail Anchor Slots: 22 gage or heavier galvanized steel dovetail anchor slots, for anchoring of masonry veneer with galvanized steel dovetail anchors provided under Division 4, Masonry.
- L. Chamfer Strips: 3/4 inch by 3/4 inch triangular fillets milled from clear, straight-grain pine, surfaced each side, or extruded vinyl type with or without nailing flange.
- M. Miscellaneous Joint Strips: Preformed strips for reveals, rustications, and similar joints fabricated of wood, metal, or plastic.
- N. Waterstops: Refer to Section 03 15 13 - Waterstops, for requirements.

2.02 FABRICATION

- A. Formwork - General: Fabricate forms in accordance with approved Shop Drawings. Maintain forms clean, smooth, and free from imperfections and distortion. Fabricate forms for architectural concrete in accordance with applicable requirements of ACI 301.
- B. Joints:
 - 1. Arrange form panels in symmetrical patterns conforming to general lines of the structure.
 - 2. Unless otherwise indicated, orient panels on vertical surfaces with long dimension horizontal, and make horizontal joints level and continuous.
 - 3. Align form panels on each side of the panel joint with fasteners common to both panels, and in a manner which will result in a continuous, unbroken concrete plane surface.
- C. Steel Forms: Use material which is clean, smooth, and free from warps, bends, kinks, rust, cracks, and matter which may stain concrete. Fabricate panels in accordance with approved Shop Drawings. Deflection between form supports from concrete placement shall not exceed 1/240 of the span length.

PART 3 - EXECUTION

3.01 LAYOUT OF FORMWORK

- A. Locate and stake out all forms and establish all lines, levels, and elevations.

3.02 CONSTRUCTION**A. Formwork:**

1. Construct formwork in accordance with the approved Shop Drawings, and in a manner that will produce finished concrete surfaces conforming to indicated design and within specified tolerances. Formwork for concrete not exposed to view in the finished work may be constructed of any material that will adequately support the weight of the concrete.
2. Make joints and seams mortar-tight. Install leakage control materials in accordance with the manufacturer's installation instructions, and in a manner that will maintain a smooth continuity of plane between abutting form panels and which will resist displacement by concreting operations.
3. Kerf wood inserts for forming keyways, reglets, and recesses in a manner that will prevent swelling and ensure ease of removal.
4. Maintain forms clean and free from indentations and warpage. Do not use rust-stained steel surfaces for forms in contact with concrete. Do not sandblast steel form surfaces to remove rust or mill scale; remove these imperfections by grinding.
5. Brace temporary closures to prevent warpage or displacement and set tightly against forms in a manner that will prevent loss of concrete mortar.
6. Support joints with extra studs or girts, and in a manner that will ensure true, square intersections.
7. Assemble forms in a manner that will facilitate their removal without damage to the concrete.
8. Construct molding shapes, recesses, and projections with smooth finish materials and install in forms with sealed joints.
9. Provide camber in formwork as required to compensate for deflections caused by weight and pressures of fresh concrete and construction loads and as otherwise indicated. Provide camber strips to compensate for deflections due to permanent loads and long-term deflections due to shrinkage and creep as required.
10. Provide construction openings in forms where required for concrete pour pockets, vibrator access holes, and inspection openings to aid in proper placement and consolidation of concrete, and close up openings during placement of concrete as applicable.
11. Provide inspection and cleanout openings in forms at bottom of walls and columns and elsewhere as required. Do not close cleanouts until inspected and accepted by the Engineer just before placing concrete.
12. Drill air escape holes in bottom members of blockouts.

13. Ensure that formed stair risers within a stair run are equal.
- B. Edge Forms and Screeds for Slabs: Set edge forms or bulkheads and intermediate screeds for slabs to obtain required elevations and contours in the finished slab surface. Support screeds substantially without penetrating waterproof membranes and vapor barriers.
- C. Corner Treatment: Form chamfers with 3/4 inch on each leg, unless otherwise indicated, and accurately shape and surface in a manner which will produce uniformly straight lines and edge joints and which will prevent mortar runs. Extend terminal edges to limits, and miter chamfer strips at changes in direction.
- D. Construction Joints:
1. Locate joints as indicated. Support forms for joints in concrete so as to rigidly maintain their positions during placement, vibration, and curing of concrete. Install keys in all joints.
 2. Locate and install construction joints, for which locations are not indicated, so as not to impair strength and appearance of the structure, and indicate such joints on Shop Drawings. Locations of construction joints require approval of the Engineer.
 3. Position joints perpendicular to longitudinal axis of pier, beam, or slab as the case may be.
 4. Locate joints in walls, vertically as indicated; at top of footing; at top of slabs on grade; at bottom of door openings; and at underside of the deepest beam or girder framing into wall; or as required to conform to indicated details.
 5. Provide keyways as indicated in construction joints in walls and slabs, and between walls and footings unless otherwise indicated. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
- E. Load Supports: Loads for construction of roof slab and suspended floor slabs shall be carried down to on-grade base slabs. These loads shall not be carried by intermediate slabs at any time. Formwork loads shall be carried only by structural elements that are supported directly by footings.

3.03 EMBEDDED ITEMS AND OPENINGS IN CONCRETE

- A. Install conduit, pipe sleeves, waterstops, appliance boxes, frames for items recessed in walls, door frames, drains, metal ties, inserts, nailing strips, blocking, grounds, and other fastening devices required for anchorage or attachment of other work. Firmly secure products in position, located accurately as indicated, before beginning concrete placement.
- B. Provide openings in concrete for passage of ducts, and provide clearances therefor as indicated on approved Shop Drawings.
- C. Where masonry walls will be tied to concrete construction in future construction, use dovetail anchor slots positioned for maximum flexibility for masonry installation.

3.04 FORM RELEASE MATERIAL

- A. Coat form contact surfaces with approved form release material before reinforcement is placed. Do not allow excess form release material to accumulate in the forms or to come into contact with surfaces that are required to be bonded to fresh concrete such as concrete reinforcement and embedded items. Apply form release material in compliance with manufacturer's application instructions.
- B. Coat steel forms with non-staining, rust-preventive form release material or otherwise protect against rusting.
- C. Apply form release material to bolts and rods that are to be removed or that are to be free to move.

3.05 REMOVAL OF FORMS

- A. Remove forms by methods which will not injure, mar, gouge, or chip concrete surfaces, overstress concrete members, or distort formwork. Use air pressure or other approved methods. Do not pry against concrete. Cut off nails flush. Leave surfaces clean and unblemished.
 - 1. Where early form removal is not necessary and will not impact the Contractor's schedule, leave forms in place at least 72 hours, unless otherwise approved by the Engineer.
- B. When repair of surface defects or finishing is required at an early age, forms may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations and its own weight.
 - 1. Concrete work that is damaged by removal operations shall be repaired as specified in Section 03 35 00 - Concrete Finishing. Where exposed surfaces are damaged beyond acceptable repairing measures, the damaged concrete shall be removed and replaced with new concrete.
- C. Top forms on sloping surfaces of concrete may be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any needed repairs or treatment required on such sloping surfaces shall be performed at once and shall be followed by the specified curing.
- D. Wood forms for wall openings shall be loosened as soon as this can be accomplished without damage to the concrete.
- E. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently so as not to be damaged by removal operations.
- F. Forms and shoring in the formwork used to support the weight of concrete in beams, suspended slabs, girders, and other structural members shall remain in place until the concrete has reached adequate strength and stiffness to support itself. Forms shall not be removed before the concrete has reached a minimum of 70 percent of the indicated design compressive strength, unless otherwise approved in writing by the Engineer.
- G. When shores and other vertical supports are so arranged that the non-load-carrying form-facing material may be removed without loosening or disturbing the shores and supports, the facing

material may be removed at an earlier age provided the concrete surfaces are not damaged by such earlier removal.

- H. Plan reshoring operations in a manner that will ensure that areas of new construction will not be required to support their own weight. Reshoring shall be in place before shoring is removed. During reshoring, do not permit live loads on new construction. Do not locate reshores in a manner and location that will overstress members or induce tensile stresses where reinforcing bars have not been provided.
- I. When removal of formwork or reshoring is based on the concrete reaching a specified strength, the concrete shall be presumed to have reached this strength when test cylinders, field cured along with the concrete they represent, have reached the strength specified for removal of formwork or reshoring. Except for the field curing and age at test, the cylinders shall be molded and tested as specified in Section 03 05 15 - Portland Cement Concrete.

3.06 FIELD QUALITY CONTROL

- A. Before placing concrete, check lines and grades of erected formwork and positioning of embedded inserts, blockouts, and joints for correctness. Verify that embedded piping and conduit are free from obstructions. Make corrections or adjustments to ensure proper size and location of concrete members and stability of forming systems.
- B. While placing concrete, provide quality control to assure that formwork and related supports have not been displaced, that loss of cement paste through joints is prevented, and that completed work will be within specified tolerances.
- C. During form removal, verify that architectural features meet the form and texture requirements of the samples approved by the Engineer.

3.07 DETECTION OF MOVEMENT

- A. Check movement using methods, such as plumb lines, tell tales, and survey equipment, to detect movement of formwork during concrete placement.

3.08 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Remove such material from the site. Apply form release coating as specified for new formwork.
- B. Align and secure joints in a manner that will preclude offsets. Do not use patched forms for exposed concrete surfaces.

END OF SECTION 03 11 00

SECTION 03 11 14

FALSEWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Layout of falsework
- B. Falsework construction.
- C. Removal of falsework.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Falsework for concrete structures will not be measured separately for payment.
- B. Payment: Falsework for concrete structures will be paid for as part of the Contract unit price or lump-sum price for the associated concrete work as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36/A36M Specification for Carbon Structural Steel
- B. California Code of Regulations, Title 8:
 - 1. Chapter 4, Subchapter 4, Construction Safety Orders
- C. State of California, Department of Transportation (CalTrans), Standard Specifications:
 - 1. Section 12 Construction Area Traffic Control Devices
 - 2. Section 51 Concrete Structures, Section 51-1.06 "Falsework"
- D. State of California, Department of Transportation (Caltrans), Office of Structure Construction:
 - 1. Falsework Manual
- E. West Coast Lumber Inspection Bureau (WCLB):
 - 1. WCLB No. 17 Standard Grading Rules

1.04 FALSEWORK DESIGN CRITERIA

- A. Regulatory Requirements: Falsework shall comply with applicable requirements of the California Code of Regulations, Title 8, Construction Safety Orders.
- B. Design Standards:

1. In addition to the requirements specified herein, comply with the Caltrans Standard Specifications Section 51-1.06, "Falsework," and the Caltrans Falsework Manual.
 2. All lumber, posts, and timbers shall be graded and grade-marked in accordance with WCLB No. 17. Provide stress-graded lumber for all structural members, conforming with the above-specified WCLB No. 17.
- C. Design Loads: Design loads for falsework shall conform with applicable requirements of Caltrans Standard Specifications, Section 51, Concrete Structures, and the Caltrans Falsework Manual.
- D. Design Stresses, Loadings, and Deflections: The maximum allowable design stresses, loadings and deflections shall conform with applicable requirements of Caltrans Standard Specifications, Section 51, Concrete Structures, and the Caltrans Falsework Manual.

1.05 SUBMITTALS

- A. Requirements: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures. Shop Drawings and supporting calculations for falsework shall be submitted to the Engineer for review and approval.
- B. Shop Drawings and Calculations:
1. Submit drawings and design calculations for all falsework proposed for concrete structures requiring falsework support. Falsework design calculations shall include the stresses and deflections in load supporting members.
 2. Where the height of any portion of the falsework, as measured from the ground line to the soffit of the superstructure, exceeds 14 feet, or where any individual falsework clear-span length exceeds 16 feet, or where provision for vehicular or pedestrian traffic through the falsework is made, such drawings shall be sealed and signed by an engineer who is currently registered as a civil or structural engineer in the State of California.
 3. Except for placement of foundation pads and piles, do not start construction of any unit of falsework until the Engineer has approved the Shop Drawings and calculations for that unit.
 4. Falsework forms shall be designed to carry the load imposed upon them without exceeding the estimated soil bearing values and anticipated settlements.
 5. When footing type foundations are proposed, determine the bearing value of the soil and show the values assumed in the design of the falsework on the falsework drawings.
 6. When pile type foundations are proposed, show the maximum horizontal distance that the top of a falsework pile may be pulled out of position to support its cap. Also, show the maximum allowed deviation of the top of the pile, in its final position, from a vertical line through the point of fixity of the pile.

7. Show anticipated total settlements of falsework and forms. These shall include falsework footings settlement and joint take-up. Falsework supporting deck slabs and overhangs on girder bridges shall be designed so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.
8. Foundations for individual steel towers where the maximum leg load exceeds 30 kips shall be designed and constructed to provide uniform settlement under all legs of each tower under all loading conditions.
9. The support systems for form panels supporting concrete deck slabs and overhangs on girder bridges shall also be considered to be falsework, and shall be designed as such.
10. Temporary bracing shall be provided, as necessary, to withstand all imposed loads during erection, construction, and removal of falsework whose height exceeds its clear distance to either the edge of any sidewalk or shoulder of any roadway that is open to the public. The falsework drawings shall show provisions for such temporary bracing or methods to be used to conform to this requirement during each phase of erection and removal. Wind loads shall be included in the design of such bracing or methods.
11. Design of falsework will not be approved by the Engineer unless based on the use of loads and conditions that are no less severe than those specified in Article 1.04.C herein, and on the use of stresses and deflections that are no greater than those specified in Article 1.04.D. The Contractor shall be responsible for the proper evaluation of falsework materials and for the design of falsework to safely carry the actual loads imposed.

- C. Forming System: Furnish form design and materials data for each forming system to be used for exposed surfaces. Coordinate with the work of Section 03 11 00 - Concrete Forming.

1.06 SPECIAL LOCATIONS

- A. In addition to the Falsework Design Criteria specified herein, falsework over roadways or railroads that are open to traffic shall be designed and constructed in accordance with applicable requirements of Caltrans Standard Specifications, Section 51, Concrete Structures, and the Caltrans Falsework Manual.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Requirements: Materials for falsework shall conform with applicable requirements of the Caltrans Standard Specifications, Section 51, Concrete Structures, and the Caltrans Falsework Manual, except as indicated or specified otherwise herein.
- B. Lumber: All falsework lumber, posts, and timbers shall be graded and grade-marked in accordance with WCLB No. 17, dressed or rough. Provide stress-graded lumber for all falsework lumber, conforming with the above-specified WCLB No. 17.
- C. Steel: ASTM A36/A36M, structural shapes as required.

PART 3 - EXECUTION

3.01 LAYOUT OF FALSEWORK

- A. Locate and stake out all forms and falsework, and establish all lines, grades, and elevations.

3.02 FALSEWORK CONSTRUCTION

- A. Construct falsework to conform with the approved falsework Shop Drawings and applicable requirements of the Caltrans Standard Specifications, Section 51, Concrete Structures, and the Caltrans Falsework Manual.

3.03 REMOVAL OF FALSEWORK

- A. Release and removal of falsework shall conform with applicable requirements of the Caltrans Standard Specifications, Section 51, Concrete Structures, and the Caltrans Falsework Manual.

END OF SECTION 03 11 14

SECTION 03 15 00

CONCRETE ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Joint fillers.
- B. Joint sealing compound.
- C. Elastomeric joint seals.
- D. Plastic pads, spacers, and fillers.

1.02 RELATED SECTIONS

- A. Waterstops are specified in Section 03 15 13 - Waterstops.
- B. Elastomeric bearing pads are specified in Section 03 15 15 - Elastomeric Bearing Pads.
- C. Elastomeric noise abatement seals at trackway acoustical barriers are specified in Section 03 40 00 - Precast Concrete.
- D. Metal stair nosings, armor protection for concrete edges, metal anchors, inserts, sleeves, and various metal accessories related to cast-in-place concrete work are specified in Section 05 50 00 - Metal Fabrications.
- E. Expansion and seismic control joints are specified in Section 07 95 00 - Expansion Control.
- F. Calking and sealants related to the sealing of openings in walls and weatherproofing of station structures are specified in Section 07 90 00 - Joint Protection.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Concrete accessories will not be measured separately for payment.
- B. Payment: Concrete accessories will be paid for as part of the indicated Contract unit price or lump-sum price for the associated concrete or paving work as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C272 Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
 - 2. ASTM C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - 3. ASTM C920 Specification for Elastomeric Joint Sealant

4. ASTM D994 Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
5. ASTM D1190 Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
6. ASTM D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
7. ASTM D1622 Test Method for Apparent Density of Rigid Cellular Plastics
8. ASTM D1751 Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
9. ASTM D2628 Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
10. ASTM D3405 Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements
11. ASTM D3406 Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements
12. ASTM D3542 Specification for Preformed Polychloroprene Elastomeric Joint Seals for Bridges
13. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit drawings showing locations of all joints to be filled and sealed.
- C. Product Data: Submit manufacturers' product data of joint fillers, sealing compounds, elastomeric joint seals, and plastic materials, verifying compliance with specified requirements.
- D. Samples: Submit 12-inch long sample of joint filler and elastomeric joint seals and one pint can of sealing compound.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Joint Filler: Premolded, of sizes and thickness indicated, conforming to ASTM D994 or ASTM D1751, as applicable.
 1. For structural joints and joints subject to movement, provide elastomeric joint seals conforming to ASTM D2628 or ASTM D3542, as applicable.

- B. Joint Sealing Compound: Concrete joint sealant, conforming to ASTM C920 (Type S or M, Class 25, Use T), ASTM D1190, ASTM D3405, or ASTM D3406, as applicable, for sealing of expansion (isolation) and contraction (control) joints in slabs and at junctions of slabs and vertical surfaces.

Color of joint sealant shall be as selected by the Engineer from manufacturer's standards.

1. For asphalt pavements, provide ASTM D3405 sealant only. For concrete pavements and roadways, provide ASTM C920 or ASTM D3406 sealant.

- C. Elastomeric Joint Seals: Preformed solid or multi-web design, virgin crystallization-resistant polychloroprene (neoprene) conforming with ASTM D2628 or ASTM D3542, as applicable. Seals shall be designed to function in a compressed installation mode.

1. Lubricant Adhesive: ASTM D2628 or ASTM D3542, as applicable.

- D. Plastic Pads, Spacers, and Fillers: Extruded closed-cell polystyrene rigid board meeting requirements of ASTM C578, Type V, with the following physical properties:

1. Minimum weight and density when tested in accordance with ASTM D1622: 3.0 pounds per cubic foot.
2. Minimum compressive strength when tested in accordance with ASTM D1621: 100 pounds per square inch.
3. Maximum water absorption when tested in accordance with ASTM C272: 0.10 percent by volume.
4. Maximum allowable flame spread when tested in accordance with ASTM E84: 10 flame-spread index (UBC Class I).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that joint surfaces are dry to the extent necessary for successful sealant application and long service life as recommended by the sealant manufacturer.
- B. Verify also that ambient and concrete-surface temperatures and humidity are within the ranges recommended by the manufacturer for successful sealant application.

3.02 PREPARATION

- A. Thoroughly clean joints free of dirt, debris, dust, and laitance.
- B. Prime joint surfaces, where required, as recommended by the manufacturer of the joint sealing compound or elastomeric joint seal, as applicable.
- C. Mix multi-component sealing compound as recommended by the manufacturer.

3.03 INSTALLATION

- A. Installation/Application Requirements: Joint fillers and sealing compounds shall be installed in accordance with the respective manufacturers' installation and application instructions. Comply also with ASTM D1190, ASTM D3405, Appendix XI., and ASTM D3406, Appendix XI., for application of sealants, as applicable. Coordinate the placement of joint fillers and securing them in position with the work of Section 03 11 00 - Concrete Formwork.
- B. Expansion (Isolation) Joints:
 - 1. Provide premolded joint filler to full depth of slabs, less 1/2 inch. Install joint filler with top edge 1/2 inch below the surface, and tool adjacent concrete edges to a 1/4-inch radius. Use steel pins to hold material in place during placing and floating of concrete. Finished joints shall be tight and leakproof.
 - 2. After a minimum of 28 days after slabs have been placed and finished, fill expansion joints with joint sealing compound to 1/8 inch below surface of slabs. No traffic shall be permitted to travel over sealed joints until sealing compound has properly cured.
- C. Contraction (Control) Joints: Saw-cut contraction joints and weakened plane joints shall be filled with joint sealing compound in areas and locations indicated. Joints shall be filled and tooled flush to within 1/16 inch of the slab surface.
- D. Roadway and Bridge: Provide elastomeric joint seals as applicable to the conditions. Install as indicated and in accordance with the manufacturer's installation instructions and recommendations.
- E. Plastic Pads, Spacers, and Fillers: Install as indicated over or against clean surfaces. Apply adhesive where required to hold material in place.

END OF SECTION 03 15 00

SECTION 03 15 13

WATERSTOPS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Waterstops.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Waterstops for concrete will not be measured separately for payment.
- B. Payment: Waterstops for concrete will be paid for as part of the indicated Contract unit price or lump-sum price for the associated concrete or paving work as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCES

- A. U. S. Army Corp of Engineers, Concrete Research Division (CRD):

1. CRD-C513 Rubber Waterstops
2. CRD-C572 Polyvinylchloride Waterstops

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit drawings showing locations of all joints to receive waterstops and methods of supporting waterstops in forms without displacement from pressure of concrete placement.
- C. Product Data: Submit manufacturers' product data of proposed waterstops for review.
- D. Samples: Submit 12-inch long sample of typical waterstop and sample of field splice.

1.05 STORAGE AND HANDLING

- A. Store waterstops in a manner that provides free circulation of air around the material.
- B. Protect waterstop material from direct sunlight while in storage, and when only partially encased in concrete for over 48 hours.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Waterstops shall conform to CRD-C513 or CRD-C572, as applicable.

WATERSTOPS

- B. Material for rubber waterstops shall be natural rubber, suitable synthetic rubber, or a blend of natural and suitable synthetic rubber.
- C. Material for PVC waterstops shall be an elastomeric plastic compound, the basic resin of which shall be polyvinyl chloride and containing any additional resins, plasticizers, or other materials needed for the material to comply with the requirements specified.
- D. Waterstops shall be manufactured by such a process that they will be dense, homogenous, and free from holes and other imperfections. The cross section of the waterstop shall be uniform and symmetrical along its entire length.
- E. Waterstops shall have the cross-sectional shape and dimensions indicated. Split-leg waterstops will not be permitted.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide waterstops for all construction joints in exterior walls, base slabs, suspended slabs, roof slabs, and other locations as indicated.
- B. Install waterstops accurately in place and secure rigidly against movement by methods adequate to assure proper support and embedment during the placement of concrete.
- C. Unless otherwise indicated, install waterstops so that embedment in concrete will be equal on both sides of the joint.
- D. Install waterstops in the longest practicable length, with joints spliced to form a continuous watertight seal for the full length of the joint.
- E. Carefully place and consolidate concrete to ensure a complete filling and bond between the concrete and waterstop. A cement-sand grout slurry may be used where necessary to assure contact and bond of waterstop and concrete without voids.
- F. When installed in an expansion joint, locate waterstop so that the closed hollow center-bulb remains in the gap of the joint, to allow for maximum elongation with minimum stress on that portion of the waterstop embedded in the concrete. Install expansion joint material and a sealant in the joint, as indicated, to prevent foreign matter from accumulating in the joint area. When a sealant is used, place a separator (backer rod) between the sealant and the waterstop to assure that both the waterstop and sealant perform properly.
- G. Repair or replace damaged, defective or misaligned waterstop material in accordance with the manufacturer's instructions.

3.02 SPLICING

- A. PVC waterstops shall be butt-spliced by applying a thermostatically controlled electric source of heat and welding material in accordance with the manufacturer's splicing instructions. Rubber waterstops shall be butt-spliced by field vulcanizing. Lapped splices will not be permitted. Splices shall have a tensile strength not less than 60 percent of the unspliced materials' tensile

WATERSTOPS

strength. Maintain continuity of waterstop and bulbs.

3.03 FIELD QUALITY CONTROL

- A. Waterstops and their joints shall be inspected for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects that could reduce the effectiveness of joints against water penetration.

END OF SECTION 03 15 13

BART Facilities Standards (BFS)

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SECTION 03 15 15

ELASTOMERIC BEARING PADS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Plain elastomeric bearing pads.
- B. Fabric-reinforced laminated bearing pads.
- C. Steel-reinforced laminated bearing pads.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Elastomeric bearing pads will not be measured separately for payment.
- B. Payment: Elastomeric bearing pads will be paid for as part of the indicated Contract unit price or lump-sum price for the associated concrete work as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M251 Plain and Laminated Elastomeric Bridge Bearings
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36/A36M Specification for Carbon Structural Steel
 - 2. ASTM A570/A570M Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
 - 3. ASTM A611 Specification for Steel, Sheet, Carbon Cold-Rolled, Structural Quality
 - 4. ASTM D395 Test Methods for Rubber Property - Compression Set
 - 5. ASTM D412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers
 - 6. ASTM D429 Test Methods for Rubber Property - Adhesion to Rigid Substrates
 - 7. ASTM D518 Test Method for Rubber Deterioration - Surface Cracking
 - 8. ASTM D573 Test Method for Rubber - Deterioration in an Air Oven
 - 9. ASTM D1149 Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber

- 10. ASTM D2240 Test Method for Rubber Property - Durometer Hardness
- 11. ASTM D4014 Specification for Plain and Steel-Laminated Elastomeric Bearings for Bridges

1.04 DEFINITIONS

- A. As used in these Specifications, the word "elastomer" or "elastomeric" means "rubber"; the words are interchangeable.

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit manufacturer's product data of elastomeric bearing pads for review.
- C. Samples: Furnish one sample elastomeric bearing pad for each type of pad used in the Work. Samples will be selected by the Engineer at random from the lots delivered to the jobsite.
- D. Certificates of Compliance: Submit certificates of compliance certifying that materials and fabrication of elastomeric bearing pads comply with these Specifications as applicable.

PART 2 - PRODUCTS

2.01 TYPES OF BEARING PADS

- A. Plain Elastomer Type: Molded elastomeric compound, or cut from previously molded strips or slabs, or extruded and cut to length, with smooth surfaces and cut edges.
- B. Fabric-Reinforced Laminated Type: Laminated pads consisting of alternate layers of elastomeric compound and glass fabric reinforcement bonded together, with top and bottom layers of reinforcement uniformly covered with 1/8 inch of elastomer.
- C. Steel-Reinforced Laminated Type: Laminated pads consisting of alternating steel laminates and internal elastomer laminates bonded together, with top and bottom layers of steel reinforcement uniformly covered with 1/4 inch of elastomer. Exposed sides shall be covered with 1/8 inch of elastomer.

2.02 MATERIALS

- A. Elastomeric Compound/Elastomer: Virgin crystallization-resistant polychloroprene as the raw elastomer. Physical requirements of the elastomeric compound include the following:
 - 1. Physical Properties:
 - a. Hardness: ASTM D2240, Type D durometer, 60, plus or minus 6.
 - b. Tensile Strength: ASTM D412, 2500 psi minimum.
 - c. Ultimate Elongation: ASTM D412, 350 percent minimum.

2. Heat Resistance: ASTM D573, 48 hours at 212 degrees F.
 - a. Change in durometer hardness: plus 15 points maximum.
 - b. Change in tensile strength: minus 15 percent maximum.
 - c. Change in ultimate elongation: minus 40 percent maximum.
 3. Compression Set: ASTM D395, Method B, 22 hours at 212 degrees F: 35 percent maximum.
 4. Ozone Cracking: ASTM D1149, 100 pphm ozone in air by volume, 20 percent strain, 104 plus or minus 2 degrees F, 100 hours mounting procedure A in accordance with ASTM D518: no cracks.
 5. Adhesion: ASTM D429, Method B, bond made during vulcanization: 40 pounds per square inch.
- B. Fabric Laminates: Fabric reinforcement shall be woven from one-hundred percent glass fibers of "E" type yarn with continuous fibers. Minimum thread count in either direction shall be 25 threads per inch. Fabric shall have either a crow foot or an 8 Harness Satin weave. Each ply of fabric shall have a breaking strength of not less than 800 pounds per inch of width in each direction. Fabric reinforcement shall be single ply at top and bottom surfaces of the pad and double ply within the pad.
- C. Steel Laminates: Steel for internal reinforcement laminates shall conform with the following requirements as indicated:
1. Steel 3/16-inch Thick and Over: Steel plate conforming to ASTM A36/A36M.
 2. Steel Under 3/16-inch Thick: Steel sheet conforming to ASTM A570/A570M, Grade C or D, or ASTM A611, Grade C or D.
- D. Adhesive: Adhesive for the installation of bearing pads to concrete and steel bearing surfaces shall be a solvent-free adhesive as appropriate for this particular installation.

2.03 FABRICATION

- A. Plain elastomer bearing pads and laminated steel bearing pads shall conform to the applicable requirements of ASTM D4014. Laminated fabric bearing pads shall conform to the applicable requirements of AASHTO M251.
- B. Pads 1/2 inch or less in thickness shall be either all elastomer or laminated. Pads over 1/2 inch thick shall be laminated. Stacking of individually laminated pads to attain thicknesses over 1/2 inch is not acceptable.
- C. Plain elastomer bearing pads shall be molded individually, or cut from previously molded strips or slabs, or extruded and cut to size. Cutting shall produce a smooth surface and no heating of the elastomer.

ELASTOMERIC BEARING PADS

- D. Laminated pads shall have reinforcement every 1/2 inch through the entire thickness. Reinforcement shall be parallel to the top and bottom surfaces of the pad. Elastomer and reinforcement together shall not exceed 1/2 inch in thickness per lamination.
- E. Laminated bearing pads shall be molded as a single unit under pressure and heat. Bonding of elastomer to reinforcement laminates shall be carried out during molding. Elastomer at outer edges of bonds to external load plates shall be shaped to avoid stress concentrations.
- F. Internal steel laminates shall be free of sharp edges. Top and bottom steel laminates shall be covered uniformly with 1/4 inch of elastomer. Sides shall be covered uniformly with 1/8 inch of elastomer.
- G. External load plates shall be protected from rusting.
- H. Comply with ASTM D4014 for fabrication tolerances.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install elastomeric bearing pads at locations indicated in accordance with indicated details.
- B. Apply adhesive to clean concrete bearing surface to a minimum thickness of 1/8 inch, and set bearing pads on adhesive bed as indicated.

END OF SECTION 03 15 15

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Steel reinforcing bars.
- B. Galvanized reinforcing bars.
- C. Epoxy-coated reinforcing bars.
- D. Wire and spiral reinforcement.
- E. Welded steel wire fabric.
- F. Steel bar mats.
- G. Tie wire.

1.02 RELATED SECTIONS

- A. Reinforcing steel for shotcrete is specified in Section 03 37 13 - Shotcrete.
- B. Reinforcing steel for prestressed concrete and precast concrete is specified in Section 03 05 18 - Prestressed Concrete, and Section 03 40 00 - Precast Concrete.
- C. Reinforcement for masonry is specified in Section 04 22 00 - Concrete Unit Masonry.
- D. Reinforcing steel for piles, drilled shaft foundations, portland cement concrete paving, concrete curbs, gutters, and walks, and utility structures is specified in their respective Sections.

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for concrete reinforcement will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for concrete reinforcement indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump-sum for concrete reinforcement, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for concrete reinforcement, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Reinforcing steel bars, including galvanized and epoxy-coated reinforcements, and wire reinforcement will be measured for payment by the pound, complete in place.

CONCRETE REINFORCING

- 1) Weights will be determined from computations based on the nominal weights listed in ACI 318, Appendix on Steel Reinforcement Information. For galvanized and epoxy-coated reinforcements, the weights of the zinc and epoxy coatings will not be included.
 - 2) Laps of bars for splices indicated will be measured for payment. Splices for Contractor's convenience will not be measured for payment. When bars are spliced by welding, the weight for payment will be as computed for lapped splices.
- b. Welded wire fabric will be measured for payment by the square yard of each configuration placed. Quantities will be the actual number of square yards measured complete in place, with no allowance for overlap.
- c. The following concrete reinforcement will be measured for payment under this Section:
- 1) Reinforcing steel, including spirals, for drilled shaft foundations as specified in Section 31 63 29 - Drilled Concrete Piers and Shafts.
 - 2) Reinforcing steel for concrete paving as specified in Section 32 13 13 - Concrete Paving.
 - 3) All cast-in-place concrete structures and slabs as specified in Section 03 30 00 - Cast-In-Place Concrete, except as specified under Article 1.03.C.1.d herein.
 - 4) Reinforcing steel for shotcrete as specified in Section 03 37 13 - Shotcrete.
 - 5) Reinforcing steel for cast-in-place prestressed concrete (post-tensioned), except prestressing steel, as specified in Section 03 05 18 - Prestressed Concrete.
- d. The following concrete reinforcement will not be measured separately for payment, but will be included in the unit measurement of the associated concrete work:
- 1) Reinforcing steel for concrete piles as specified in Section 31 62 00 - Driven Piles.
 - 2) Reinforcing steel for concrete curbs, gutters, and walks as specified in Section 32 16 21 - Concrete Curbs, Gutters, and Walks.
 - 2) Reinforcing steel for utility structures as specified in Section 33 05 16 - Utility Structures.
 - 3) Prestressing steel for prestressed concrete, including concrete reinforcement for precast/prestressed concrete as specified in Section 03 05 18 - Prestressed Concrete.

- 4) Reinforcing steel for precast concrete as specified in Section 03 40 00 - Precast Concrete.
 - 5) Reinforcing steel for concrete ductbanks as specified in Section 20 50 16 - Underground Ductwork and Structures for Facility Services.
- e. The following reinforcement and accessory items will not be measured separately for payment:
- 1) Clips, ties, bar supports, dowels, spacers, chairs, or other devices for holding reinforcing steel in place, including zinc and epoxy coatings.
 - 2) Additional reinforcing steel for splices permitted by the Engineer for Contractor's convenience.
 - 3) Reinforcing steel and accessories, including zinc and epoxy coatings, required for lump sum items.
2. Payment:
- a. Reinforcing steel bars, wire reinforcement, and welded wire fabric will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement methods specified above.
 - b. Payment for reinforcement and accessory items listed under Article 1.03.C.1.e herein will be included in the Contract unit prices for the associated cast-in-place concrete work.

1.04 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 Specifications for Structural Concrete for Buildings
2. ACI 315 Details and Detailing of Concrete Reinforcement
3. ACI 318 Building Code Requirements for Structural Concrete

B. American Society for Testing and Materials (ASTM):

1. ASTM A82 Specification for Steel Wire, Plain, for Concrete Reinforcement
2. ASTM A184/
A184M Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
3. ASTM A185 Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement
4. ASTM A370 Test Methods and Definitions for Mechanical Testing of Steel Products

CONCRETE REINFORCING

5. ASTM A496 Specification for Steel Wire, Deformed, for Concrete Reinforcement
6. ASTM A497 Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
7. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
8. ASTM A706 Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement
9. ASTM A767/
A767M Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
10. ASTM A775/
A775M Specification for Epoxy-Coated Reinforcing Steel Bars
11. ASTM A884/
A884M Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement
12. ASTM D3963/
D3963M Specification for Epoxy-Coated Reinforcing Steel
13. ASTM E8 Test Methods of Tension Testing of Metallic Materials
14. ASTM E165 Test Method for Liquid Penetrant Examination

C. American Welding Society (AWS):

1. AWS D1.4 Structural Welding Code - Reinforcing Steel

D. Concrete Reinforcing Steel Institute (CRSI):

1. CRSI Manual of Standard Practice
2. CRSI, Placing Reinforcing Bars

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings:

1. Submit bar lists, bending diagrams and schedules, and placement plans and details for all reinforcing steel. Bar lists shall include weights.
2. Indicate descriptions, details, dimensions, arrangements and assemblies, and locations of reinforcing steel. Include number of pieces, sizes, and markings of reinforcing steel, laps and splices, supporting devices and accessories, and any other information required for

fabrication and placement. Indicate any adjustments required as specified in Article 1.06.B.

3. Check Contract Drawings for anchor bolt schedules and locations, anchors, hangers, inserts, conduits, sleeves, blockouts, and any other items to be cast in concrete for possible interference with reinforcing steel. Indicate required clearances on Shop Drawings.
4. Detail reinforcing steel in accordance with requirements of the ACI 315. Indicate individual weight of each bar, total weight of each bar size, and total weight of all bars on the list. Base calculated weights upon nominal weights specified in ACI 318, Appendix on Steel Reinforcement Information.

C. Product Data:

1. Submit manufacturers' product data and installation instructions for proprietary manufactured materials and reinforcement accessories.
2. Submit manufacturers' product data and installation instructions for proprietary exothermic metal splicing systems and proprietary mechanical coupler splicing systems when such splicing methods are permitted.

D. Samples:

1. When galvanized or epoxy-coated reinforcing bars are indicated, furnish two 12-inch long samples and two additional samples bent to minimum radius of the rebar from each size and lot shipped to the jobsite.
2. Samples shall be representative of the materials furnished. These samples, as well as any additional random samples taken by the Engineer, may be tested for specification compliance.
3. Failure of any sample to meet specification requirements shall be cause for rejection of that lot.

E. Certificates:

1. For each lot or load of reinforcing steel delivered to the jobsite, furnish mill affidavits or test reports of compliance or similar certification, certifying the grades and physical and chemical properties of the reinforcing steel and conformance with applicable ASTM Specifications, including ASTM A370, Method A9.
2. For galvanized and epoxy-coated reinforcing bars, furnish certificates of compliance with ASTM A767/A767M for galvanized bars and with ASTM A775/A775M and D3963/D3963M for epoxy-coated bars.
3. For welders, furnish welding certificates or affidavits attesting to the welders' qualifications to perform the indicated welding in accordance with applicable requirements of AWS D1.4.

4. For exothermic sleeve coupler splicing, furnish certificates or affidavits attesting to the crew's special qualifications to perform the splicing.

1.06 QUALITY ASSURANCE

A. Tolerances:

1. Fabrication: Fabricate bars to meet the following tolerances:
 - a. Sheared length: plus or minus 1 inch.
 - b. Depth of truss bars: plus 0, minus 1/2 inch.
 - c. Overall dimensions of stirrups, ties and spirals: plus or minus 1/2 inch.
 - d. All other bends: plus or minus 1 inch.
 - e. Fabrication tolerances not indicated on the Contract Drawings or specified above shall comply with the applicable requirements of ACI 301 and CRSI Manual of Standard Practice, Chapter 7.
2. Placement: Place bars to the following tolerances:
 - a. Clear distance to formed surfaces: plus or minus 1/4 inch.
 - b. Minimum spacing between bars: minus 1/4 inch.
 - c. Top bars in slabs and beams:
 - 1) Member 8 inches deep or less: plus or minus 1/4 inch.
 - 2) Member greater than 8 inches, but less than 2 feet deep: plus or minus 1/2 inch.
 - 3) Members 2 feet or more deep: plus or minus 1 inch.
 - d. Crosswise of members: spaced evenly within 2 inches.
 - e. Lengthwise of members: plus or minus 2 inches.
 - f. Placement tolerances not indicated on the Contract Drawings or specified above shall comply with the requirements of ACI 301, ACI 318, or CRSI Manual of Standard Practice, as applicable.

- B. Adjustments: Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or in excess of the above tolerances, the resulting arrangement of bars shall require the Engineer's approval. Minimum spacings shall not be decreased, and the required number of bars shall be placed. Bars moved to permit access for cleanup operations shall be properly replaced and secured before the start of concrete placement.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcing bars to the fabricator in bundles, limited to one size and length of bar, securely tied and identified with plastic tags in an exposed position indicating the mill, the melt or heat number, and the grade and size of bars.
- B. Deliver steel reinforcement to the jobsite, store, and cover in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, oil, or other cause which might impair bond with concrete.
- C. Deliver steel reinforcement to the jobsite properly tagged and identified, as specified herein in Article 2.03, in accordance with approved Shop Drawings.
- D. Handle and store galvanized and epoxy-coated reinforcement in a manner which will prevent damage to the coatings. For epoxy-coated reinforcement, comply with the requirements of ASTM D3963/D3963M.
- E. Maintain identification of steel reinforcement after bundles are broken.
- F. Provide special facilities for the storage and handling of exothermic materials as recommended by the splicing system manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Reinforcing Bars:
 - 1. Billet-Steel Bars: ASTM A615, Grade 60, except that the maximum yield strength shall be 78,000 psi, and the tensile strength shall be not less than 1.25 times the actual yield strength. ASTM A615 bars may be welded only if the more stringent requirements of ANSI/AWS D1.4 are followed.
 - 2. Low-Alloy Steel Bars: ASTM A706. Provide ASTM A706 bars for bars to be welded.
 - 3. Weights of Bars: Refer to ACI 318, Appendix on Steel Reinforcement Information.
- B. Galvanized Reinforcing Bars: ASTM A706 or ASTM A615, as applicable, galvanized in accordance with ASTM A767/A767M, Class I coating. Bars shall be cut and bent cold before galvanizing.
- C. Epoxy-coated Reinforcing Bars: ASTM A706 or ASTM A615, as applicable, epoxy-coated in accordance with ASTM A775/A775M and ASTM D3963/D3963M. Coating material shall conform to ASTM A775/A775M and ASTM D3963/D3963M, Annex A1, green in color. Furnish acceptance test reports for each lot of epoxy-coated bars delivered to the site. Bars shall be cut and bent cold before applying coating material.
- D. Wire and Spiral Reinforcement: ASTM A82 for plain wire and ASTM A496 for deformed wire.

- E. Welded Steel Wire Fabric - Plain Wire: ASTM A185, wire sizes and center-to-center spacings as indicated.
- F. Welded Steel Wire Fabric - Deformed Wire: ASTM A497, wire sizes and center-to-center spacings as indicated.
- G. Welded Steel Wire Fabric - Epoxy-Coated: ASTM A884/A884M, wire sizes and center-to-center spacings as indicated.
- H. Steel Bar Mats - Deformed Bars: ASTM A184/A184M, using ASTM A706 deformed bars, sizes and spacings of members as indicated, welded or clipped at intersections.
- I. Accessories: Provide reinforcement accessories, consisting of bar supports, spacers, hangers, chairs, ties, and similar items as required for spacing, assembling, and supporting reinforcement in place. Conform with CRSI referenced standards and the following requirements:
 - 1. For footings, grade beams, and slabs on grade, provide supports with precast concrete or mortar bases or plates or horizontal runners where wetted base materials will not support chair legs.
 - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms or are in close proximity to finish surfaces, provide supports with legs which are galvanized, plastic-protected, or stainless steel.
 - 3. For galvanized reinforcement, provide all galvanized accessories.
 - 4. For epoxy-coated reinforcement, provide accessories which are nylon-, epoxy-, or plastic-coated.
- J. Tie Wire: No. 16 gage or heavier, black or galvanized, soft or commercial grade steel tie wire. For galvanized reinforcement, provide zinc-coated wire. For epoxy-coated reinforcement, provide nylon-, epoxy-, or plastic-coated wire. Where tie wire is in close proximity to finish surfaces of exposed-to-view concrete, provide soft stainless steel wire.
- K. Welding Electrodes: E90XX low hydrogen electrodes (for shielded metal arc welding.)
- L. Exothermic Metal-Filled Sleeve Coupler:
 - 1. System Description: Provide bar splicing connection, produced by a standard exothermic process whereby molten filler metal, contained by a high-strength steel sleeve of larger inside diameter than adjoining bars, is introduced into the annular space between the bars and the sleeve as well as between the ends of the bars. Splicing system shall produce complete fusion with 100 percent penetration of the joint.
 - 2. Spliced Strength in Tension: 125 percent of the yield strength of connected reinforcing bars.
- M. Mechanical Splice Coupler:

1. System Description: Provide bar-splicing connections, produced by threaded reinforcing bar ends and threaded coupler, or by sleeves hydraulically pressed or forged onto butt-ended reinforcing bars, or by other proprietary mechanical splicing method as proposed by the Contractor and approved by the Engineer. Mechanical splice couplers shall be capable of being installed in the clear space indicated and to provide the required clearances.
2. Spliced Strength in Tension: Minimum 125 percent of the yield strength of connected reinforcing bars, unless otherwise indicated.

2.02 FABRICATION

- A. Fabrication Standards: Fabrication of steel reinforcement shall be in accordance with the Contract Drawings and approved Shop Drawings. Where specific details are not indicated, comply with applicable requirements of ACI 301, ACI 318, and CRSI Manual of Standard Practice.
- B. Cutting and Bending: Cutting and bending shall be performed at a central location, equipped and suitable for the purpose. Bars shall be accurately cut and bent as indicated. Bars shall be bent cold. Heating of bars for bending or straightening will not be permitted. Bars shall not be bent or straightened in any manner which will injure the material. Label all bars in accordance with bending diagrams and schedules, and secure like pieces in bundles when appropriate.
- C. Welding:
 1. Welding of reinforcement, where indicated and approved, including preparation of bars, shall conform with applicable requirements of AWS D1.4. Welders shall be prequalified in accordance with AWS D1.4, Chapter 6.
 2. Use full penetration butt welds by the electric-arc method unless otherwise indicated or approved. Weld splices shall develop 125 percent of the specified yield strength of the bars, or of the smaller bar in transition splices.
 3. Clean bars of oil, grease, dirt, and other foreign matter and flame-dry before welding. Preheat bars before welding in accordance with AWS D1.4, Chapter 5. Stagger splices in adjacent bars a minimum of 48 inches.
- D. Repair of Damaged Coatings: Bars for galvanized reinforcement shall be cut and bent cold before galvanizing. Galvanized and epoxy coatings damaged by shipping, handling, or cutting and bending shall be repaired as specified in ACI 301, and ASTM A767/A767M, ASTM A775/A775M, ASTM A884/A884M, and ASTM D3963/D3963M, as applicable.

2.03 IDENTIFICATION

- A. Reinforcing steel shall be bundled and tagged with grades and sizes, heat numbers, and suitable identification marks for checking, sorting, and placing. Sizes and mark numbers shall correspond to placing Shop Drawings and schedules. Tags and markings shall be water-resistant and shall not be removed until steel reinforcement is placed in position.

2.04 REINFORCING STEEL FOR DUCT BANKS

- A. Reinforcing steel shall be provided for duct banks. Longitudinal steel shall be provided with a minimum total cross sectional area of 0.0018 times the gross area of the duct bank. The maximum spacing of reinforcing bars shall be 18 inches, with a minimum of one bar provided in each corner. Tie bars in the transverse direction enclosing the longitudinal steel bars shall also be provided, with a minimum size of No. 3 bars at a minimum spacing of 12 inches. The minimum clear concrete cover over reinforcing steel shall be 3 inches where concrete is cast directly against earth, and 1-1/2 inches where concrete is cast directly against fabricated formwork.
- B. Where duct banks enter rigid underground structures, reinforcing steel shall be provided to tie the duct bank to the structure. Details shall be provided showing methods used to prevent damage to duct banks due to differential settlement at these points.

PART 3 - EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that surfaces, over or against which concrete is to be placed, are clean and in proper condition for placing reinforcement.
- B. Verify that items to be embedded in concrete inserts, sleeves, and block-outs are secured in place as required.

3.02 PLACING

- A. **Placing Standards:** Reinforcing steel shall be placed in accordance with the Contract Drawings, approved Shop Drawings, and the applicable requirements of ACI 301, ACI 318, CRSI Manual of Standard Practice, and CRSI Placing Reinforcing Bars. Install reinforcement accurately and secure against movement, particularly under the weight of workers and the placement of concrete.
- B. **Reinforcing Supports:** Bars shall be supported on metal or plastic chairs, spacers, and hangers, accurately placed and securely fastened to steel reinforcement in place. Support legs of accessories in forms without embedding in the form surface. Hoops and stirrups shall be accurately spaced and wired to the reinforcement.
- C. **Placing and Tying:** Reinforcing steel shall be installed in place, spaced, and rigidly and securely tied or wired with tie wire at all splices and at crossing points and intersections in the positions indicated. It is not necessary to tie bars at every intersection. Comply with requirements of CRSI Placing Reinforcing Bars, Chapter 10. Snap ties are acceptable for intermediate intersections. Rebending of bars on the job to fit different conditions will not be permitted. Point ends of wire ties away from adjacent form surfaces.
- D. **Spacing:** Center-to-center distance between parallel bars shall be in accordance with the Contract Drawings or, where not indicated, the minimum clear spacing shall be in accordance with ACI 318.

- E. Longitudinal Location of Bends and Ends of Bar: A maximum of plus or minus 3 inches from the indicated location will be permitted, provided that specified protective concrete cover at ends of members is not reduced by more than 1/2 inch.
- F. Splices:
1. Lapped Splices:
 - a. Laps of splices shall be securely tied together to maintain the alignment of the bars, to provide the required minimum clearances, and to transfer stress by bond. Lapped splices and development lengths not shown shall be detailed to develop Class B lapping lengths and development lengths in tension, respectively, in accordance with ACI 318.
 - b. Splices of alternate bars shall be staggered a minimum clear offset of 2 feet between splices. Splices shall be tied with tie wire, or splices may be lap welded in accordance with AWS D1.4. Lapped splices are not permitted for No. 14 and No. 18 bars, or when specifically excluded by Contract provisions regardless of size.
 2. Exothermic Metal-Filled Coupler Splices: Conform with the product manufacturer's installation instructions and recommendations and with applicable requirements of AWS D1.4 for exothermic welding.
 3. Mechanical Coupler Splices:
 - a. Perform installation of coupler and tightening of joint assembly in accordance with the coupler manufacturer's installation instructions and recommendations.
 - b. Reinforcing bars to be joined shall be shop threaded using special machinery to produce the required tapered threads. Where previously threaded bars must be cut or where threads are damaged, bars shall be replaced, or an alternate splicing system approved by the Engineer shall be substituted. Bars shall not be rethreaded, and damaged threads shall not be repaired in the field.
 - c. Prior to joining, inspect all threads and assure that they have been properly made and are clean.
 - d. Rotate coupler and bar initially by hand or wrench until snug (approximately 3-1/4 to 4 turns). Apply 24-inch minimum pipe wrench and turn coupler (or bar) until further turning is resisted with the application of a minimum torque of 200 foot-pounds. Suitably mark joint to indicate that tightening has been completed.
 - e. For proprietary mechanical splicing systems not specified herein, installation shall conform with the manufacturer's installation instructions.
 4. Spiral Reinforcement Splices: Splices shall conform with applicable requirements of ACI 318.

G. Dowels: Provide dowels where indicated or required for connecting construction and for maintaining structural and reinforcement continuity. Dowels shall be tied securely in place before concrete is deposited. Provide additional bars for proper support and anchorage where required. Do not bend dowels after embedment.

H. Welded Wire Fabric:

1. Wire fabric shall be installed in lengths as long as practicable and shall be wire-tied at all laps and splices. End laps shall be offset in adjacent widths. Lap welded wire fabric in accordance with applicable requirements of ACI 318.
2. Where required welded wire fabric shall be secured in position with suitable supports, accessories, and tie wire as indicated and required to ensure against movement from workers and placement of concrete lift fabric as concrete is placed to assure proper embedment at position indicated.

3.03 PROTECTIVE CONCRETE COVER

A. Minimum concrete coverage for steel reinforcement shall be as specified in ACI 301, ACI 318, or CRSI Manual of Standard Practice. If there is a conflict between the standards specified, the thicker concrete coverage shall govern.

3.04 CLEANING:

A. Reinforcement at time of depositing concrete shall be free of corrosion and coatings that may impair bond with concrete, such as form oil, mill scale, or loose deposits of rust and other corrosion.

3.05 FIELD QUALITY CONTROL

A. In accordance with Section 01 45 00 - Quality Control, quality control inspections and tests to be performed by the Contractor include the following:

1. Placement of Reinforcing Steel: Visual inspection of reinforcing steel in place, including bar supports, tied laps and intersections, welded wire fabric, and bar mats.
2. Welds:
 - a. Visual inspection of reinforcing bar welds.
 - b. Tension tests of welded butt joints. Tests shall be performed on sample welds produced by the Contractor in accordance with ASTM E8.
 - c. Nondestructive tests of installed welded butt joints shall be performed in accordance with ASTM E165.
 - d. Inspections and tests shall be performed in accordance with the applicable requirements of AWS D1.4, Chapters 6 and 7.
3. Exothermic/Coupler Splices:

CONCRETE REINFORCING

- a. Continuous visual inspection for the first eight hours, minimum, of the work as performed by any crew, and again by any replacement crew. All splices require visual inspection before concrete may be placed.
 - b. Visual inspection shall be performed in accordance with the product manufacturer's instructions and recommendations for such inspection.
 - c. Inspections shall measure and record all voids. Exothermic rebar splices shall be accepted, provided measured "void limits," per end, do not exceed manufacturer's specified "void limits."
 - d. Splices indicating improper fill, slag at tap hole, or blowouts shall be rejected.
4. Mechanical Coupler Splices: Test 100 percent of the couplers, using a 24-inch click-type torque wrench calibrated to 200 foot-pounds. Minimum turning torque of 200 foot-pounds shall be applied to the extent that further turning is resisted. Where tests reveal failure of couplers to be properly tightened, couplers shall be removed and replaced.
- B. For exothermic/coupler splices, the Contractor shall provide qualification splices for each position as follows:
1. One sister splice for the first 25 splices; thereafter, one sister splice for every 50 splices.
 2. Sister splices shall be laboratory tested by the Engineer for strength in tension (125 percent of the yield strength of connecting bars).

END OF SECTION 03 20 00

BART Facilities Standards (BFS)

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conveying and placing concrete.
- B. Placement under water.
- C. Consolidation.
- D. Construction joints.
- E. Expansion and contraction joints.
- F. Curing and protection.

1.02 RELATED SECTIONS

- A. Portland cement concrete specified in Section 03 05 15 - Portland Cement Concrete.
- B. Finishing and curing of formed and unformed concrete surfaces, including repair and patching of surface defects, are specified in Section 03 35 00 - Concrete Finishing.
- C. Shotcrete is specified in Section 03 37 13 - Shotcrete.
- D. Vapor barrier under slabs on grade is specified in Section 07 26 00 - Vapor Retarders.

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for cast-in-place concrete will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for cast-in-place concrete indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump-sum for cast-in-place concrete, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for cast-in-place concrete, the unit-price method of measurement and payment will be as follows:

1. Measurement:

- a. Except as specified otherwise in other Sections of these Specifications or the Contract Specifications, each class of concrete and type of placement of cast-in-place concrete will be measured for payment by the cubic yard, and quantities will be computed, based on the neat lines or pay lines, section profiles, and dimensions indicated on the Contract Drawings, without deduction for chamfers, reinforcing steel and embedded items, and openings and recesses having an area of less than

two square feet.

- b. Additional concrete used to replace overcut or for overbreak, or to repair or replace defective work, will not be measured separately for payment.
2. Payment: Cast-in-place concrete will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.04 DEFINITIONS

- A. The words and terms used in these Specifications conform with the definitions given in ACI 116R.

1.05 REFERENCES

- A. American Concrete Institute (ACI):

- 1. ACI 116R Cement and Concrete Terminology
- 2. ACI 117 Standard Specification for Tolerances for Concrete Construction and Materials
- 3. ACI 301 Standard Specifications for Structural Concrete
- 4. ACI 302.1R Guide for Concrete Floor and Slab Construction
- 5. ACI 303.1 Standard Specification for Cast-In-Place Architectural Concrete
- 6. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete
- 7. ACI 304.2R Placing Concrete by Pumping Methods
- 8. ACI 305R Hot Weather Concreting
- 9. ACI 306.1 Standard Specification for Cold Weather Concreting
- 10. ACI 308 Standard Practice for Curing Concrete
- 11. ACI 309R Guide for Consolidation of Concrete
- 12. ACI 318 Building Code Requirements for Structural Concrete
- 13. ACI 503.2 Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive

- B. American Society for Testing and Materials (ASTM):

- 1. ASTM C31 Standard Practice of Making and Curing Concrete Test Specimens in the Field

2. ASTM C94 Specification for Ready-Mixed Concrete
3. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings:
 1. Submit drawings that indicate the locations of all joints in concrete, including construction joints, expansion joints, isolation joints, and contraction joints. Coordinate with the requirements specified in Section 03 11 00 - Concrete Forming.
 2. Submit drawings that indicate concrete placement schedule, method, sequence, location, and boundaries. Include each type and class of concrete, and quantity in cubic yards.
- C. Product Data: Submit manufacturer's product data for epoxy adhesive.
- D. Records and Reports: Report the location in the finished work of each mix design, and the start and completion times of placement of each batch of concrete placed for each date concrete is placed.

1.07 QUALITY ASSURANCE

- A. Tolerances:
 1. Concrete Tolerances: Comply with the requirements of ACI 117 as applicable. Coordinate with the requirements specified in Section 03 11 00 - Concrete Forming.
 2. Tolerances for Slabs and Flatwork: Comply with the requirements specified in Section 03 35 00 - Concrete Finishing.
- B. Architectural Concrete: Where concrete is indicated as architectural concrete exposed to public view, such concrete shall be produced in accordance with applicable requirements of ACI 301 and ACI 303.1.
- C. Site Mock-Ups:
 1. Refer to Section 01 43 38 - Field Samples and Mockups, for mock-up requirements and procedures.
 2. Construct site mock-ups for all architectural concrete work and formed concrete that will be exposed to the public in the finished work, not less than 4 feet by 6 feet in surface area, for review and acceptance by the Engineer, before starting the placement of concrete.

3. Approved site mock-ups shall set the standard for the various architectural concrete features, formed finishes, and colors of the concrete. Provide as many mock-ups as required to show all the different features and formed surfaces of the concrete.
- D. Cold Joints: Cold joints in concrete will not be permitted unless planned and treated properly as construction joints.
- E. Monitoring of Formwork: Provide monitoring of forms and embedded items to detect movement, or forms and embedded items out-of-alignment, from pressure of concrete placement.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Delivering and placing of concrete in hot weather and cold weather shall conform with applicable requirements of ACI 305R and ACI 306.1 and Section 03 05 15 - Portland Cement Concrete.
- B. Do not place concrete when the rate of evaporation of surface moisture from concrete exceeds 0.2 pounds per square foot per hour as indicated in Figure 2.1.5 of ACI 305R.
- C. Do not place concrete in, or adjacent to, any structure where piles are required until all piles in the structure have been driven or installed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Formwork: Refer to Section 03 11 00 - Concrete Forming, for requirements.
- B. Joint Fillers and Sealers: Refer to Section 03 15 00 - Concrete Accessories, for requirements.
- C. Waterstops: Refer to Section 03 15 13 - Waterstops, for requirements.
- D. Reinforcing Steel: Refer to Section 03 20 00 - Concrete Reinforcing, for requirements.
- E. Portland Cement Concrete: Refer to Section 03 05 15 - Portland Cement Concrete, for mix designs and other requirements.
- F. Concrete Curing Materials: Refer to Section 03 35 00 - Concrete Finishing, for requirements.
- G. Vapor Barrier Materials: Refer to Section 07 26 00 - Vapor Retarders, for requirements.
- H. Epoxy Adhesive: ASTM C881, Type II for non-load-bearing concrete and Type V for load-bearing concrete, Grade and Class as determined by project conditions and requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect forms, earth bearing surfaces, reinforcement, and embedded items, and obtain the

Engineer's written approval before placing concrete. Complete and sign a pour card on the form supplied by the Engineer. The Engineer shall countersign the card prior to commencing the pour.

3.02 PREPARATION

- A. Place concrete under the observation of the Engineer and with the Contractor's Quality Control Representative present to document requirements and results of the placement.
- B. Whenever possible, place concrete during normal working hours. When concrete- placement schedules require concrete placement at times other than normal working hours, ensure that the Engineer is notified and is present at the time of placement.
- C. Do not place concrete until conditions and facilities for the storage, handling, and transportation of concrete test specimens are in compliance with the requirements of ASTM C31 and Section 03 05 15 - Portland Cement Concrete, and are approved by the Engineer.
- D. Prior to placement of concrete, the subgrade shall be in a firm, well-drained condition, and of adequate and uniform load-bearing nature to support construction personnel, construction materials, construction equipment, and steel reinforcing mats without tracking, rutting, heaving, or settlement. All weak, soft, saturated, or otherwise unsuitable material shall be removed and replaced with structural backfill or lean concrete.
- E. All structure foundations, including those for Stations and for subway box, shall be inspected and approved, in writing, by a qualified, independent geotechnical engineer prior to placement of footings and base slabs, to confirm the adequacy of the supporting soil for concrete placement.
- F. Earth bottoms or bearing surfaces for footings and slabs shall be dampened but not saturated or muddied just before placing concrete.

3.03 TRANSPORTING

- A. Concrete shall be central-mixed concrete from a central batch plant, transported to the jobsite in a truck mixer, in accordance with the requirements specified in Section 03 05 15 - Portland Cement Concrete, and ASTM C94.
- B. Transport concrete to the jobsite in a manner that will assure efficient delivery of concrete to the point of placement without adversely altering specified properties with regard to water-cement ratio, slump, air entrainment, and homogeneity.

3.04 CONVEYING AND PLACING

- A. Placement Standards: Conveying and placing of concrete shall conform with applicable requirements of ACI 301, ACI 302.1R, ACI 304R, and ACI 318.

B. Handling and Depositing:

1. Concrete placing equipment shall have sufficient capacity to provide a placement rate that will preclude cold joints and that shall deposit the concrete without segregation or loss of ingredients.
2. Concrete placement, once started, shall be carried on as a continuous operation until the section of approved size and shape is completed.
3. Concrete shall be handled as rapidly as practicable from the mixer to the place of final deposit by methods that prevent the separation or loss of ingredients. Concrete shall be deposited, as nearly as practicable, in its final horizontal position to avoid redistribution or flowing.
4. Concrete shall not be dropped freely where reinforcing will cause segregation, nor shall it be dropped freely more than 5 feet. Concrete shall be deposited to maintain a plastic surface approximately horizontal.
5. In placing walls, columns, or thin sections (6 inches or less in thickness) of heights greater than 10 feet, concrete placement rate, lift thickness, and time intervals between lifts shall be as indicated on approved Shop Drawings. Openings in the form, elephant trunk tremies, or other approved devices, shall be used that will permit the concrete to be placed without segregation or accumulation of hardened concrete on the forms or metal reinforcement above the level of the fresh concrete.
6. Concrete that has partially hardened shall not be deposited in the work. The discharge of concrete shall be started not later than 60 minutes after the introduction of mixing water. Placing of concrete shall be completed within 90 minutes after the first introduction of water into the mix.

C. Pumping:

1. Concrete may be placed by pumping if the maximum slump can be maintained and if accepted in writing by the Engineer for the location proposed.
2. Placing concrete by pumping methods shall conform with applicable requirements of ACI 304R and ACI 304.2R.
3. Equipment for pumping shall be of such size and design as to ensure a continuous flow of concrete at the delivery end without separation of materials. Concrete from end of hose shall have a free fall of less than 5 feet. Pump hoses shall be supported on horses or similar devices so that reinforcement or post-tensioning ducts or tendons are not moved from their original position.
4. The concrete mix shall be designed to the same requirements as specified in Section 03 05 15 - Portland Cement Concrete, and may be altered for placement purposes with the prior approval of the Engineer.

3.05 PLACEMENT UNDER WATER

- A. Placement Standards: Placing of concrete in or under water shall conform with requirements of ACI 304R. All concrete to be placed under water shall be placed by the tremie method or by direct pumping.
- B. Placement Requirements: Deposit concrete in water only when indicated or approved in writing by the Engineer, and only under the observation of the Engineer. Use only tremie method and direct pumping with equipment that has been accepted by the Engineer.

3.06 CONSOLIDATION

- A. Concrete shall be thoroughly consolidated and compacted by mechanical vibration during placement in accordance with the requirements of ACI 309R.
- B. The Engineer will inspect concrete placement to confirm that proper placing methods are being employed, and that special techniques are being used in congested areas and around obstructions such as pipes and other embedded items. Check installation of embedded items for correct location and orientation during concrete placement.
- C. Conduct vibration in a systematic manner by competent, skilled, and experienced workers, with regularly maintained vibrators, and with sufficient back-up units at the jobsite. Use the largest and most powerful vibrator that can be effectively operated in the given work, with a minimum frequency of 8,000 vibrations or impulses per minute, and of sufficient amplitude to effectively consolidate the concrete.
- D. Insert and withdraw the vibrator vertically at uniform spacing over the entire area of the placement. Space the distance between insertions such that "spheres of influence" of each insertion overlap.
- E. Conduct vibration so as to produce concrete that is of uniform texture and appearance, free of honeycombing, air and rock pockets, streaking, cold joints, and visible lift lines.
- F. On vertical surfaces and on all architectural concrete where an as-cast finish is required, use additional vibration and spading as required to bring a full surface of mortar against the forms, so as to eliminate objectionable air voids, bug holes, and other surface defects. Additional procedures for vibrating concrete shall consist of the following:
 - 1. Reduce the distance between internal vibration insertions and increase the time for each insertion.
 - 2. Insert the vibrator as close to the face of the form as possible, without contacting the form.
 - 3. Use spading as a supplement to vibration at forms to provide fully filled out form surfaces without air holes and rock pockets.
 - 4. Provide vibration of forms only if approved by the Engineer for the location.

3.07 CONSTRUCTION JOINTS

- A. Construction joints will be permitted only where indicated or approved by the Engineer.
- B. Provide and prepare construction joints and install waterstops in accordance with the applicable requirements of ACI 301 and ACI 304R, and as specified in Section 03 11 00 - Concrete Forming.
- C. Make construction joints straight and as inconspicuous as possible, and in exact vertical and horizontal alignment with the structure, as the case may be.
- D. Use approved key, at least 1-1/2 inches in depth, at joints unless otherwise indicated or approved by the Engineer.
- E. Thoroughly clean the surface of the concrete at construction joints and remove laitance, loose or defective concrete, coatings, sand, sealing compound and other foreign material. Prepare surfaces of joints by sandblasting or other approved methods to remove laitance and expose aggregate uniformly.
- F. Immediately before new concrete is placed, wet the joint surfaces and remove standing water. To allow for shrinkage, do not place new concrete against the hardened concrete side of a construction joint for a minimum of 72 hours.
- G. Locate joints that are not indicated so that the strength of the structure is not impaired. Joint types and their locations are subject to prior approval of the Engineer.
- H. Ensure that reinforcement is continuous across construction joints.
- I. Place waterstops in construction joints where indicated.
- J. Where bonding of the joint is required, provide epoxy adhesive hereinbefore specified and apply in accordance with ACI 503.2.
- K. Retighten forms and dampen concrete surfaces before concrete placing is continued.
- L. Allow at least 72 hours to elapse before continuing concrete placement at a construction joint. Approval for accelerating the minimum time elapsing between adjacent placements will be based on tests and methods that confirm that a minimum moisture loss at a relatively constant temperature will be maintained for the period as necessary to control the heat of hydration and hardening of concrete, and to prevent shrinkage and thermal cracking.

3.08 EXPANSION AND CONTRACTION JOINTS

- A. Refer to Section 03 11 00 - Concrete Forming, for slab screeds and for formwork where expansion and contraction joints are indicated as architectural features, such as reveals or rustications.
- B. Refer to Section 03 15 00 - Concrete Accessories, for expansion joint filler material and joint sealing compound.

- C. Refer to Section 03 35 00 - Concrete Finishing, for finishing of edges of expansion joints in slabs with curved edging tool.

3.09 CURING AND PROTECTION

- A. Curing of concrete shall conform with applicable requirements of ACI 301 and ACI 308, except that the curing duration shall be a minimum period of ten days. HVFAC shall be cured a minimum of 28 days including an initial 10 days of moist curing. Curing with earth, sand, sawdust, straw, and hay will not be permitted.
- B. Keep concrete in a moist condition from the time it is placed until it has cured for at least ten days. Keep forms damp and cool until removal of forms.
- C. Immediately upon removal of forms, exposed concrete surfaces shall be kept moist by applying an approved curing compound or by covering with damp curing materials as specified in Section 03 35 00 - Concrete Finishing.
- D. Concrete shall not be permitted to dry during the curing period because of finishing operations.
- E. Protect fresh concrete from hot sun, drying winds, rain, damage, or soiling. Fog spray freshly placed slabs after bleed water dissipates and after finishing operations commence. Allow no slabs to become dry at any time until finishing operations are complete.
- F. Finishing and curing of slabs are specified in Section 03 35 00 - Concrete Finishing.
- G. Protect concrete from injurious action of the elements and defacement of any kind. Protect exposed concrete corners from traffic or use that will damage them in any way.
- H. Protect concrete during the curing period from mechanical and physical stresses that may be caused by heavy equipment movement, subjecting the concrete to load stress, load shock, or excessive vibration.

3.10 REPAIR OF SURFACE DEFECTS

- A. Refer to Section 03 35 00 - Concrete Finishing, for requirements.

END OF SECTION 03 30 00

BART Facilities Standards (BFS)

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SECTION 03 35 00

CONCRETE FINISHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Repair of surface defects
- B. Finishing of formed surfaces
- C. Slabs and flatwork
- D. Curing

1.02 RELATED SECTIONS

- A. Concrete formwork is specified in Section 03 11 00 - Concrete Forming.
- B. Cast-in-place concrete is specified in Section 03 30 00 - Cast-In-Place Concrete.
- C. Concrete topping slabs for station concourse and platforms are specified in Section 03 53 00 - Concrete Topping.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Repair of surface defects, finishing, and curing of concrete will not be measured separately for payment.
- B. Payment: Repair of surface defects, finishing, and curing of concrete will be paid for as part of the indicated Contract unit prices or lump-sum prices for the associated concrete work as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M182 Burlap Cloth Made from Jute or Kenaf
- B. American Concrete Institute (ACI):
 - 1. ACI 117 Standard Specification for Tolerances for Concrete Construction and Materials
 - 2. ACI 301 Standard Specifications for Structural Concrete
 - 3. ACI 308 Standard Practice for Curing Concrete
 - 4. ACI 503.4 Standard Specification for Repairing Concrete with Epoxy Mortars
- C. American Society for Testing and Materials (ASTM):

1. ASTM C33 Specification for Concrete Aggregates
2. ASTM C150 Specification for Portland Cement
3. ASTM C171 Specifications for Sheet Materials for Curing Concrete
4. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
5. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
6. ASTM E1155 Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers

D. State of California, Department of Transportation (CalTrans), Standard Specifications:

1. Section 51 Concrete Structures

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures. Submittals involving exposed concrete finishes require approval of the Engineer before they may be incorporated in the Work.
- B. Shop Drawings: Submit drawings, or diagrams to scale, that indicate the location in plan and elevation of all concrete finishes.
- C. Product Data: Submit manufacturers' product data for manufactured products.
- D. Samples:
 1. Submit 1/2-pint sample container of aluminum oxide and silicon carbide abrasive grit for review and acceptance where "non-slip finish" is indicated.
 2. Submit samples not less than 12 inches by 12 inches in size of each type of sand blast finish, indicating materials and methods used to produce the sand blast finishes. Review by the Engineer will be for color and texture only. Approved samples will become the Engineer's control samples.

1.06 QUALITY ASSURANCE

- A. Finishes:
 1. Finishing of formed concrete surfaces shall conform to applicable requirements of ACI 301.
 2. Finishes for slabs and flatwork shall conform to applicable requirements of ACI 301.
 3. Special architectural finishes for formed concrete surfaces shall conform with applicable requirements of ACI 301.

4. Bridge deck finishes shall conform to applicable requirements of Caltrans Standard Specifications Section 51.
- B. Curing: Conform to requirements of ACI 301 and ACI 308, as applicable, and requirements specified herein.
 - C. Site Mock-Ups: Provide site mock-ups, at least 3 feet by 4 feet in size, of finishes of formed surfaces in exposed locations and of exposed slab finishes for the Engineer's review and approval. Refer to Section 01 43 38 - Field Samples and Mock-ups, for requirements and procedures.
 - D. Site Mock-ups of Architectural Concrete: Provide site mock-ups of architectural concrete showing finish texture and pattern of exposed formed concrete surfaces.
 1. Size of mock-up shall be a minimum of 8 feet by 10 feet, unless otherwise approved by the Engineer to be smaller.
 2. The number of mock-up panels required shall be the number necessary to obtain the Engineer's approval of pattern and texture of panel.
 3. Approved mock-up shall be used as the standard for the aesthetic quality of the surface finish of architectural concrete.
 - E. Requirements of Regulatory Agencies: Comply with air pollution regulations of governing authorities for sand-blasting activities and operations.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT: The Contractor shall furnish all materials, tools, equipment, facilities, and services as required for performing the required concrete-finishing work.

2.02 REPAIR AND FINISHING MATERIALS

- A. Portland Cement: ASTM C150, Type II, of same brand as used in the work. Furnish white portland cement where required to produce color matching color of surrounding concrete.
- B. Aggregate:
 1. For Bonding Grout: ASTM C33, washed clean sand passing a No. 30 sieve.
 2. For Patching Mortar: ASTM C33, washed clean, graded fine aggregate of suitable size for areas to be repaired. Clean coarse aggregate up to Size No. 8 may be added for repair of larger pockets and voids.
- C. Commercial Patching Mortar: A structural repair mortar may be furnished if appropriate for the use and approved by the Engineer.
- D. Epoxy Patching Mortar: As specified in ACI 503.4 for Epoxy Mortar.

- E. Epoxy Adhesive: ASTM C881, Type II or Type V, epoxy-based bonding agent.
- F. Anti-Slip Abrasive Grit: Virgin grain Aluminum Oxide or Silicon Carbide particles, or a mixture of the two.

2.03 CURING MATERIALS

- A. Damp Curing Materials:
 - 1. Waterproof Sheet Materials: ASTM C171, waterproof paper with white paper face, polyethylene film pigmented white, or white burlap-polyethylene sheeting.
 - 2. Burlap: AASHTO M182, of class or weight suitable for the use and location. Do not use burlap where concrete is exposed to direct sunlight.
- B. Curing Compound: ASTM C309, liquid membrane-forming curing compound, Type 1, Class A or B as appropriate for the use or location.
 - 1. Where concrete surfaces will receive architectural finishes, such as resilient floor coverings or paint, or membrane waterproofing, membrane-forming curing compound shall not leave a coating or residue that will impair bond of adhesives, paints, and coatings with concrete.

PART 3 - EXECUTION

3.01 REPAIR OF SURFACE DEFECTS

- A. Repair Standards: Repair of surface defects shall conform with applicable requirements of ACI 301. When using epoxy mortar, conform with applicable requirements of ACI 503.4.
- B. Surface Defects:
 - 1. Repair of surface defects shall begin immediately after form removal. For repair with epoxy mortar, concrete shall be dry.
 - 2. Surface defects are defined to include: form-tie holes, air voids or pockets, bug holes with a nominal diameter or depth greater than 1/4-inch, honeycombed areas, rock pockets, visible construction joints, fins and burrs.
 - 3. Repair of surface defects shall be tightly bonded and shall result in concrete surfaces of uniform color and texture, matching adjacent surfaces, and free of shrinkage cracks.
- C. Repair Work:
 - 1. Remove honeycombed and other defective concrete down to sound concrete. Saw-cut the edges perpendicular to the surface or slightly undercut. Feather-edges will not be permitted. Dampen the area to be patched and an area at least 6 inches wide surrounding it to prevent absorption of water from the patching mortar.
 - 2. Where rock pockets or similar defects or voids expose steel reinforcement, cutout to solid surface behind the reinforcing steel to provide suitable key-lock for patching mortar. Patching mortar shall envelope the exposed reinforcing bar.

3. Bond patching mortar to concrete with bonding grout or epoxy adhesive. Bonding grout shall consist of 1 part portland cement to 1 part No. 30 mesh sand, mixed to the consistency of a thick cream, and then well brushed onto the concrete. Bond commercial patching mortar to concrete in accordance with the manufacturer's instructions.
4. Make the patching mortar of the same materials and of approximately the same proportions as used for the concrete, except omit the coarse aggregate. Use not more than 1 part portland cement to 2-1/2 parts sand by damp loose volume, and substitute white portland cement for a portion of the regular gray portland cement to produce patching mix matching the surrounding concrete in color when dry. Determine the proportion of white portland cement by trial mixes and test areas, prior to repair of actual defective areas.
5. After surface water has evaporated from the area to be patched, brush the bond coat well into the surface. When the bond coat begins to lose the water sheen, apply the patching mortar. Compact the mortar into place and strike off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, leave the patch undisturbed for at least 1 hour before being finally finished. Keep the patched area damp for 7 days.
6. Neatly finish patched surfaces to match adjacent surrounding surface texture of concrete. Grind or fill surfaces to produce level and plumb, true planes.
7. For walls exposed in the finish work, form tie holes shall be patched and finished flush with adjacent surface. For holes passing entirely through walls, a plunger type injection gun or other suitable device shall be used to completely fill the holes.
8. Patching of honeycombed areas or rock pockets that are too large and unsatisfactory for mortar patching shall be cut out to solid surface, keyed, and packed solid with matching concrete to produce firm bond and flush surface. Patching shall match texture of adjacent surfaces where exposed in the finished work.
9. Repair work in exposed locations that does not match the texture and color of surrounding adjacent surfaces or that was not well performed shall be removed and performed again until the repair work conforms with Specification requirements.
10. Surfaces to receive membrane waterproofing shall have fins and loose material removed, and voids and cracks patched flush with adjacent surfaces.
11. Completed repairs shall be cured as herein specified under Article 3.04, Curing.

3.02 FINISHING OF FORMED SURFACES

A. Unexposed Surfaces:

1. Concrete that will not be exposed in the completed structure shall be any form finish as specified in Section 03 11 00 - Concrete Forming, and ACI 301 for "rough form finish."
2. Concrete to receive membrane waterproofing shall receive a "smooth form finish" in accordance with ACI 301.

- B. Exposed Surfaces: Unless indicated otherwise, concrete that will be exposed in the completed structure shall receive the following finishes as indicated:
1. Smooth Form Finish: Conform to ACI 301.
 2. Smooth Rubbed Finish: Conform to ACI 301.
 3. Grout Cleaned Finish: Conform to ACI 301.
 4. Unspecified Finish: When finish is not indicated, provide "smooth form finish" as specified above.
- C. Sand Blast Finish:
1. Blasting Operations and Requirements:
 - a. Apply sandblasted finish to exposed concrete surfaces where indicated.
 - b. Perform sand blasting at least 72 hours after placement of concrete. Coordinate with formwork construction, concrete placement schedule, and formwork removal to ensure that surfaces to be blast finished are blasted at the same age for uniform results.
 - c. Determine type of nozzle, nozzle pressure, and blasting techniques required to match the Engineer's control samples.
 - d. Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line.
 2. Depths of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surface to match the Engineer's control samples as follows:
 - a. Brush Sand Blast Finish: Remove cement matrix to expose face of fine aggregate; no reveal.
 - b. Light Sand Blast Finish: Expose fine aggregate with occasional exposure of coarse aggregate; maximum 1/16-inch reveal.
 - c. Medium Sand Blast Finish: Generally expose coarse aggregate; 3/16-inch to 1/4-inch reveal.
 3. Surface Continuity: Perform sand blast finishing in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns of variances in depths of cuts as indicated.
 4. Construction Joints: Use technique acceptable to the Engineer to achieve uniform treatment of construction joints.

5. Protection and Repair:
 - a. Protect adjacent materials and finishes from dust, dirt, and other surface or physical damage during abrasive blast finishing operations. Provide protection as required and remove from site at completion of the work.
 - b. Repair or replace other work damaged by finishing operations.
6. Clean-up: Maintain control of concrete chips, dust, and debris in each area of the work. Clean up and remove such material at the completion of each day of operation. Prevent migration of airborne materials by use of tarpaulins, wind breaks, and similar containing devices.

3.03 SLABS AND FLATWORK

- A. Placement and Finishing Standards: Slabs and flatwork shall be placed, consolidated, and finished in accordance with applicable requirements of ACI 301. Coordinate with Section 03 30 00 - Cast-In-Place Concrete, as applicable.
 1. High volume fly ash concrete (HVFAC) exhibits little or no bleed water. Commence finishing as soon as power screeding is complete, and commence initial curing as soon as finishing has been completed.
- B. Placement:
 1. Slabs and flatwork shall be placed and finished monolithically. Strike off and screed slabs to true, plane surfaces at required elevations, and thoroughly compact concrete with vibrators, floats, and tampers to force coarse aggregate below the surface. Finish slab within four hours of concrete placement.
 2. Whether indicated or not, in areas where drains occur, slope finished slab to drains. Slope shall be a minimum of 1/8-inch per foot unless otherwise indicated.
- C. Slab Finishes: Unless indicated otherwise, slabs and flatwork shall receive the following finishes as indicated:
 1. Scratched Finish: Conform to ACI 301. Provide "scratched finish" for slab substrates to receive cementitious toppings or finishes, such as terrazzo or mortar setting bed for ceramic tile.
 2. Floated Finish: Conform to ACI 301. Provide "floated finish" for track slabs and mud slabs and for slabs and flatwork to receive roofing and membrane waterproofing.
 3. Troweled Finish: Conform to ACI 301. Provide "troweled finish" for interior slabs and flatwork to be exposed in the completed structure, for slabs to receive resilient floor coverings, and for flatwork to receive elastomeric bearing pads.
 4. Broom Finish: Conform to ACI 301. Exact texture and coarseness of the broom finish shall match the approved site mock-up. Provide fine or medium-coarse "broom finish" as

indicated for exterior sidewalks and paving, exterior ramps, equipment and transformer pads, and subway invert slab.

5. Nonslip Finish: Conform to ACI 301. Nonslip materials shall be aluminum oxide and silicone carbide grit particles. Provide "nonslip finish" for interior pedestrian ramps, walkways, subway cross-passage floors, and other floor areas where indicated.
6. Swirl Pattern Finish: Provide for garage floors. After basic floating operations have been completed, hand float slabs using wood float to produce a continuous swirl patterned surface, free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near surface. Use natural arm circular motion to produce rows of approximately one-foot radius swirl pattern covering approximately half of the preceding row with each successive row.
7. Unspecified Finish: When finish is not indicated or specified, provide finishes as specified in ACI 301.

D. Surface Tolerances: As specified herein:

1. Flat Tolerance: Slabs and flatwork with "troweled finish" and with "nonslip finish."
2. Straightedge Tolerance: Slabs and flatwork with fine "broom finish" or medium-coarse "broom finish."
3. Bullfloated Tolerance: Slabs and flatwork with "scratched finish," with "floated finish," and with coarse "broom finish."

E. Joints:

1. Construction, expansion, isolation, and contraction joints shall be located as indicated. Construction joints shall act as contraction joints. Where additional contraction joints are required to prevent shrinkage cracks, saw-cut such joints. All joints shall be straight and true to line. Saw-cut joints not less than twelve hours nor more than twenty-four hours after placing concrete, unless otherwise approved by the Engineer.
2. Mark-off lines or edges at formed construction and expansion joints shall be finished with 1/4-inch radius curved edging tool, neat and true to line, uniform throughout.

3.04 CURING

A. Curing Standards: Curing of concrete shall conform with applicable requirements of ACI 301 and ACI 308, except that the duration of the curing period shall be ten days. Curing with earth, sand, sawdust, straw, and hay will not be permitted.

B. Curing Requirements:

1. Concrete shall be cured with waterproof sheet materials, damp burlap, or curing compounds.

2. Curing compounds shall not be used on top of ballasted aerial structures and on surfaces when their use may be detrimental to bonding of concrete, mortar, membrane waterproofing, calking and sealants, adhesives, plaster, paint, or the specified surface finish or coating.

C. Damp Curing:

1. Vertical surfaces shall be cured by keeping the forms wet at all times and by leaving the forms in place as long as possible as specified in Section 03 11 00 - Concrete Forming. After removal of forms, concrete shall be kept continuously damp by fog spraying or otherwise washing down the concrete in an accepted manner until ten days after placing. Protect exposed surfaces by covering with sheet materials or burlap kept continuously moist.
2. Horizontal surfaces shall be cured and protected by covering the finished surfaces with waterproof sheet materials or damp burlap, left in place for a minimum of ten days and kept continuously moist.
3. Fog spray freshly placed slabs until finishing operations commence. Allow no slabs to become dry until finishing operations are complete.

D. Curing HVFAC: Initiate damp curing as soon as finishing has been completed. Damp cure for a minimum of ten days. Continue curing for a total of 28 days. Curing after initial ten days may be by damp curing or using membrane-forming curing compound. Use evaporation reducer between finish operations, as necessary, to protect concrete from rapid drying

E. Curing Compound: Application of curing compound shall conform to applicable requirements of ACI 308.

3.05 PROTECTION

- A. Protect exposed concrete surfaces, including flatwork, as required to prevent damage from impact or strains.
- B. Protect fresh concrete from drying winds, rain, damage, or soiling.
- C. Refer to Section 03 30 00 - Cast-In-Place Concrete, Article 3.09, for additional requirements.

3.06 TOLERANCES

- A. Formed Surfaces: Conform with applicable requirements of ACI 117.
 1. Where elastomeric bearing pads are indicated, the level plane upon which bearing pads are placed shall not vary more than 1/16-inch from a 10-foot straightedge placed in any direction across the area and the area shall extend a minimum of 1 inch beyond the limits of the pads.
 2. Bearing surfaces of girders on a slope or girders with a camber shall be finished on a horizontal/level plane so that loads are uniformly distributed over the entire surface of the elastomeric bearing pads.

3. The finished plane shall not vary more than 1/8-inch from the elevation indicated.
- B. Slabs and Flatwork: Conform to applicable classification requirements of ASTM E1155, as follows:
1. Very Flat Tolerance: F_F 50, F_L 30. True plane with maximum variation of 1/8-inch in 10 feet when measured with a 10-foot straightedge placed anywhere on the slab in any direction.
 2. Flat Tolerance: F_F 30, F_L 20. True plane with maximum variation of 3/16-inch in 10 feet when measured with a 10-foot straightedge placed anywhere on the slab in any direction.
 3. Straightedge Tolerance: F_F 20, F_L 15. True plane with maximum variation of 5/16-inch in 10 feet when measured with a 10-foot straightedge placed anywhere on the slab in any direction.
 4. Bullfloated Tolerance: F_F 15, F_L 13. True plane with maximum variation of 1/2 inch in 10 feet when measured with a 10-foot straightedge placed anywhere on the slab in any direction.

END OF SECTION 03 35 00

SECTION 03 37 13

SHOTCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Preparation of substrate surfaces
- B. Shotcrete placement
- C. Curing

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for shotcrete will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for shotcrete indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump-sum for shotcrete, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Price: If the Bid Schedule indicates a unit price for shotcrete, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Shotcrete will be measured for payment by the cubic yard of each mix placed in the work. The quantity for payment will be the actual or indicated square area placed multiplied by the thickness indicated on the Contract Drawings, unless a different thickness is approved by the Engineer.
 - b. Reinforcing steel will be measured for payment by the pound as specified in Section 03 20 00 - Concrete Reinforcing.
 - c. Rebound will not be measured or included for payment.
 - 2. Payment: shotcrete will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.02.C.1.

1.03 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 506.2 Specifications for Materials, Proportioning, and Application of Shotcrete
 - 2. ACI 506.3R Guide to Certification of Shotcrete Nozzlemen
- B. American Society for Testing and Materials (ASTM):

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1. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
2. ASTM C33 Specification for Concrete Aggregates
3. ASTM C42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
4. ASTM C94 Specification for Ready-Mixed Concrete
5. ASTM C150 Specification for Portland Cement
6. ASTM C494 Specification for Chemical Admixtures for Concrete
7. ASTM E329 Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.04 DEFINITIONS

- A. "Shotcrete" is defined as pneumatically placed concrete: A portland-cement concrete mixture conveyed through a hose and nozzle, and shot onto a surface at high speed by means of air pressure.

1.05 SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submittals shall include the following requirements:
 1. Mix design;
 2. Methods of application and equipment;
 3. Certificates of compliance for materials;
 4. Affidavit of compliance with ACI 506.3R for nozzle operators;
 5. Test results; and
 6. Sample test panels.

1.06 QUALITY ASSURANCE

- A. Shotcrete work shall be performed by a firm or company regularly engaged in the business of applying shotcrete materials, using nozzle operators and workers skilled and experienced in the type of work specified.
- B. Shotcrete supervisor shall have not less than two years experience as a shotcrete nozzle operator.

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- C. Nozzle operator shall have not less than one year experience and, upon request of the Engineer, shall demonstrate ability to properly place shotcrete.
- D. Proof of compliance with ACI 506.3R shall be furnished for each nozzle operator.

1.07 ENVIRONMENTAL CONDITIONS

- A. Shotcrete shall not be placed during inclement or windy weather.
- B. Proper protective clothing shall be worn by operators, and any person in the area shall wear a mask during shotcreting until operations are stopped and the dust has cleared.

1.08 PROTECTION: Protect adjacent surfaces from overspray and damage due to shotcreting operations. Prevent dust nuisance.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type II. Type III cement may be used, subject to written approval of the Engineer.
- B. Aggregate: ASTM C33 normal weight aggregate with combined gradation of coarse and fine aggregates conforming to ACI 506.2, Gradation No. 1 or Gradation No. 2, as applicable to the work.
 - 1. Maximum aggregate size may be varied, subject to acceptance by the Engineer.
 - 2. Specific gravity of aggregate shall be not less than 2.50.
- C. Water: Clean and potable, free of impurities detrimental to shotcrete.
- D. Admixture: ASTM C494, Type C or Type E, containing no water-soluble chlorides or materials corrosive to steel or other properties that may cause cracking or spalling (for wet-mix shotcrete only.)
- E. Ground Wires: No. 18 or 20 gage steel annealed wire.
- F. Thickness Pins: Noncorrosive thickness-indication pins designed not to cause infiltration of water through shotcrete.
- G. Reinforcing Steel: Comply with applicable requirements of Section 03 20 00 - Concrete Reinforcing.

2.02 MIX DESIGN

- A. Design of shotcrete mix, whether dry-mix shotcrete or wet-mix shotcrete, including recommended amounts of admixture and water to be used, shall be obtained by the Contractor from a qualified independent testing laboratory or agency, or from a mill or ready-mix plant, properly equipped to design shotcrete/concrete mixes. The laboratory, agency, mill or ready-mix plant shall meet the applicable requirements of ASTM E329, and shall meet with approval

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of the Engineer. The mix design shall be certified and signed by a professional engineer who is currently registered as a civil or structural engineer in the State of California. Costs of obtaining the mix design shall be paid for by the Contractor.

- B. Shotcrete mix shall conform with the following requirements:
 - 1. Proportion of cement to aggregate shall be as required to achieve the indicated or specified strength.
 - 2. Water content at time of discharge from nozzle shall not exceed amount required to achieve the maximum permitted slump.
 - 3. Compressive strength of shotcrete shall be not less than the indicated or specified 28-day compressive strength (pounds per square inch).
- C. Upon receipt of acceptable shotcrete mix design and test results from the pre-approved independent testing laboratory, agency, mill, or ready-mix plant, conforming with specified requirements, the Contractor shall submit the accepted mix design to the Engineer for review prior to placing any shotcrete.
- D. Shotcrete shall not be placed until the submitted mix design has been approved by the Engineer in writing.

2.03 EQUIPMENT AND MIXING

- A. Equipment Standards: Equipment shall be appropriate and suitable for dry-mix or wet-mix shotcrete, as applicable, in accordance with the requirements of ACI 506.2.
- B. Batching and Mixing Equipment: Materials shall be batched by weight and machine mixed, and delivered to the site pre-mixed. For wet-mix shotcrete, conform with the applicable requirements of ASTM C94 for ready-mixed concrete.
- C. Delivery Equipment: Conform with the applicable requirements of ACI 506.2. Equipment shall be capable of discharging mixture into delivery hose under close control and shall deliver a continuous stream of material at the proper volume to discharge nozzle. Discharge nozzle shall be equipped with a manually operated and adjustable air-injection system for directing an even distribution of air through the mixture. Nozzle shall deliver a conical discharge stream of uniform appearance. Equipment shall be cleaned daily and inspected for worn parts. Plaster guns are not permitted.
- D. Air Supply: System shall employ a properly operating compressor of ample capacity to perform the work. Comply with capacity requirements specified in ACI 506.2, with modification for hose lengths and working heights.

PART 3 - EXECUTION

3.01 EXAMINATION OF SUBSTRATE SURFACES

- A. Examine earth, rock, concrete, and masonry substrate surfaces, as applicable, and determine that such substrate surfaces have been properly prepared as hereinafter specified under Article 3.02.

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- B. Inspect soil anchors, if required by the Contract Specifications, and determine that they are of correct size and type, and properly located and installed.
- C. Inspect reinforcing steel and determine that it is properly placed and tied, that sufficient clearances have been provided, and that it is free of grease, oil, loose rust, and other coatings that may impair bond with concrete.
- D. Assure that sleeves and other items to be embedded in shotcrete are in place and that provisions for penetrations have been made.
- E. Proceeding with shotcrete placement shall imply acceptance of substrate surfaces and conditions as satisfactory.

3.02 PREPARATION OF SUBSTRATE SURFACES

- A. Prepare earth, rock, concrete, and masonry substrate surfaces, as applicable, in accordance with ACI 506.2.
- B. Rock faces shall be free of loose rock.
- C. Absorptive substrate surfaces shall be evenly dampened before placing shotcrete.
- D. Formwork shall be designed and constructed to provide for escape of compressed air and rebound during shotcrete placement. Coordinate with Section 03 11 00 - Concrete Forming.
- E. Drain any free-standing water away from shotcrete operations.
- F. Provide ground wires to establish thickness and surface planes. Install vertically and horizontally as required. Do not penetrate waterproof membranes.
- G. As an alternative to ground wires, thickness measuring pins may be used to establish layer thickness and surface plane, provided such pins do not penetrate waterproof membranes and do not detrimentally damage substrates. Install pins on 5 foot centers in each direction.

3.03 SHOTCRETE PLACEMENT

- A. Operation and Placement Standards: Shotcrete operations and placement shall conform with the applicable requirements of ACI 506.2.
- B. Gunning/Nozzle Operation:
 - 1. Build each layer by making several passes over the working area. Thickness of each layer shall be governed by the requirement that sagging of shotcrete shall not occur. Maintain top surface of thick layers at 45 degree slope. Each layer to be covered by a succeeding layer shall be allowed to take its initial set.
 - 2. Laitance, loose material, and rebound shall be removed by air-jetting. Laitance that has taken a final set shall be removed by sandblasting and the surface cleaned with air-water jet. All layers to be shot shall be damp.
 - 3. Unless otherwise permitted, begin application at the lowest elevation.

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4. Do not trowel or finish initial layers in any way.
- C. Rebound: Any rebound or accumulated loose aggregate shall be removed from the surface to be covered prior to placing succeeding layers. Rebound shall not be salvaged for reuse.
- D. Construction Joints: Unfinished work shall not stand more than 30 minutes unless construction joints are provided for. Construction joints shall be designed and provided as specified in Section 03 30 00 - Cast-In-Place Concrete. Entire joint surface shall be cleaned, roughened, and dampened prior to application of additional shotcrete.
- E. Finishing: Bring shotcrete layers to within 1/4 inch of final finished surface. When surface has taken its initial set, trim excess material with a sharp edge cutting screed. Remove ground wires. Provide flash coat or finish coat as required for the final finish. Final finish shall be as specified in the Contract Specifications. Comply with applicable requirements of ACI 506.2.

3.04 CURING

- A. Immediately following shotcrete finishing, surfaces shall be cured for not less than seven days using an approved curing method as specified in ACI 506.2.

3.05 CLEANING

- A. Clean surfaces and work site of rebound and waste materials, and remove from the site.

3.06 FIELD QUALITY CONTROL

- A. Requirements: Conform with applicable requirements of Section 01 45 00 - Quality Control. All tests, cores, and core tests shall be performed by an independent testing laboratory or agency employed by the Contractor at no additional cost to the District.
- B. Inspections:
 1. Visual inspection by the Engineer will be performed of the shotcrete work, including equipment, materials, forms, reinforcement, embedded items, placement, finishing, curing, and protection of the finished product.
 2. Surfaces may be sounded with a hammer to locate drummy or hollow-sounding areas resulting from rebound pockets or lack of bond. Such hollow-sounding areas, voids, sags, and other defects shall be carefully cut out and replaced.
- C. Quality Control Tests:
 1. Test Panels:
 - a. From each 50 cubic yards of each shotcrete mix, or fraction thereof, applied in the work by each crew in each shooting position, fabricate four unreinforced test panels, each 18-inches square and 7-1/2 inches thick. Fabricate test panels in accordance with ACI 506.2. Properly cure test panels in accordance with ASTM C31 and ACI 506.2.

SHOTCRETE

- b. Test panels will be visually examined by the Engineer, and shall be tested by an independent testing laboratory or agency employed by the Contractor at no additional cost to the District. Strength of shotcrete shall be considered acceptable when the average of all strength tests, as well as the average of three consecutive strength tests, representing each shotcrete mix is equal to at least 85 percent of the specified design strength and no individual strength test is less than 75 percent of the design strength. Strength tests shall be performed in accordance with ASTM C42.
 - c. The Engineer will require, at no additional expense to the District, adjustments to the mix proportions, requalification of the shotcreting crew, or additional curing of the shotcrete if either of the following conditions occur:
 - 1) The average seven-day strength of any two specimens for the shotcrete mix is less than 70 percent of the specified 28-day strength, (three days for High-Early Strength Design); or
 - 2) The average 28-day strength of any two specimens for the shotcrete mix is less than 100 percent of the specified 28-day strength.
2. Test Cores:
- a. Should the test panels indicate that shotcrete not meeting the specified requirements has been produced, the Engineer will require tests of cores, taken from the areas represented by the test panels, to determine compliance of the in-place shotcrete with the specified requirements.
 - b. Test cores shall be 3 inches minimum diameters, obtained and tested in accordance with ASTM C42.
 - c. Three cores shall be taken for each determination of in-place strength. Shotcrete in the area represented by the core tests shall be considered structurally adequate if the average of the three cores is equal to at least 85 percent of the specified design strength and no single core is less than 75 percent of the design strength. Locations represented by erratic core strengths shall be ordered to be retested at the direction of the Engineer.
 - d. Fill core holes with low-slump concrete or mortar of same mix design as the placed shotcrete.

END OF SECTION 03 37 13

BART Facilities Standards (BFS)

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SECTION 03 40 00

PRECAST CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing Steel
- B. Portland Cement Concrete
- C. Anchors, Lift Devices, and Accessories
- D. Stair Nosing
- E. Dielectric Insulation at Platform Edge
- F. Noise Abatement Seal

1.02 RELATED SECTIONS

- A. Precast concrete structures for utilities are specified in Section 33 05 16 - Utility Structures.
- B. Concrete formwork is specified in Section 03 11 00 - Concrete Forming.
- C. Reinforcing steel for concrete is specified in Section 03 20 00 - Concrete Reinforcing.
- D. Portland-cement concrete is specified in Section 03 05 15 - Portland Cement Concrete.
- E. Finishing of formed and unformed concrete surfaces, including repair of surface defects, are specified in Section 03 35 00 - Concrete Finishing, except as specified otherwise herein.
- F. Precast, prestressed concrete is specified in Section 03 05 18 - Prestressed Concrete.
- G. Steel supporting brackets and plates are specified in Section 05 50 00 - Metal Fabrications.

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for precast concrete will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for precast concrete indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump-sum for precast concrete, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for precast concrete, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:

- a. Precast concrete units will be measured for payment by the individual unit (each), erected and installed in place, multiplied by the total number of identical units installed.
 - b. Each different type and size of precast concrete unit will be measured separately for payment.
 - c. All other items specified in this Section will be considered incidental to precast concrete units and will not be measured separately for payment.
2. Payment: Precast concrete will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.04 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 Standard Specifications for Structural Concrete
2. ACI 318 Building Code Requirements for Structural Concrete

B. American Society for Testing and Materials (ASTM):

1. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
4. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
5. ASTM C494 Specification for Chemical Admixtures for Concrete
6. ASTM C509 Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
7. ASTM C542 Specification for Lock-Strip Gaskets
8. ASTM C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
9. ASTM C1017 Specification for Chemical Admixtures for Use in Producing Flowing Concrete

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10. ASTM D257 Test Methods for DC Resistance or Conductance of Insulating Materials
11. ASTM D638 Test Method for Tensile Properties of Plastics
12. ASTM D1622 Test Method for Apparent Density of Rigid Cellular Plastics
13. ASTM D2240 Test Method for Rubber Property - Durometer Hardness

C. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code - Steel
2. AWS D1.4 Structural Welding Code - Reinforcing Steel

D. Precast/Prestressed Concrete Institute (PCI):

1. PCI MNL 117 Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products

105 DEFINITIONS

- A. Regular Precast: Acoustical barrier panels and such other members or components as indicated.
- B. Architectural Precast: Stair components, windscreen and bench components, bollards precast concrete bases, and such other architectural precast members or components as indicated.

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit Shop Drawings showing the following:
1. Detailed drawings of panels, members, and components, showing dimensions and sections of each.
 2. Quantities, dimensions, and locations of sleeves, anchors, brackets, inserts, reglets, reinforcing steel, lift devices, accessories, and methods of securing same in forms.
 3. Casting, consolidating, and finishing procedures.
- C. Product Data: Submit manufacturer's product data of manufactured products and accessories. Include manufacturer's detailed drawings and dimensions when applicable.
- D. Samples: Samples require approval of the Engineer, as follows:
1. For precast concrete to be exposed in the finished work to public view, submit form facing material, 12 inches by 12 inches or larger in size as appropriate.

2. For precast concrete to receive sandblasted or other surface finish, submit sample of concrete with specified finish, 12 inches by 12 inches or larger in size as appropriate.
- E. Quality Plan: In compliance with applicable requirements of Section 01 45 00 - Quality Control, the Contractor shall provide a quality control plan to ensure uniformity of materials, conformance with accepted mix designs, and compliance with these Specifications.
- F. Certificates:
1. Submit evidence of current plant certification under the PCI Plant Certification Program or approval by the International Conference of Building Officials (ICBO).
 2. Submit manufacturers' certifications of compliance for materials as required by PCI MNL-117.
 3. For welders, furnish welding certificates or affidavits attesting to the welders' qualifications to perform the indicated and specified welding.

1.07 QUALITY ASSURANCE

- A. Qualifications of Fabricator:
1. Fabricator of precast concrete products shall be an active and approved participant in the PCI Plant Certification Program or an ICBO-approved precast fabricator.
 2. Precast concrete work shall be produced in a plant or production facility by a fabricator who has been regularly and continuously engaged in the manufacture of precast concrete products.
 3. Fabricator shall have sufficient production capacity to produce the required units without causing any delay in the work.
- B. Qualifications of Welders: Welders shall be prequalified in accordance with AWS D1.1 or AWS D1.4, as applicable to the work.
- C. Tolerances: Fabricate and erect precast concrete members within the tolerances recommended in PCI MNL-117.
- D. Mock-Ups: Construct sample panel or unit at the casting plant, of the actual item, or section of item not less than 10 square feet in surface area, of the features, finish, and color of concrete surfaces exposed to public view, for review and acceptance by the Engineer, prior to starting production.
- E. Control Samples: All finishes and colors shall match the Engineer's control samples. Control samples require the Engineer's approval before they may be used as a standard.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, and store units in a manner that will prevent damage to the members.

- B. If storage of precast units at the site is necessary, store units in a manner that will prevent cracking, distortion, staining, or other damage. Support members at their normal support points.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel: Comply with applicable requirements of Section 03 20 00 - Concrete Reinforcing.
- B. Portland Cement Concrete:
 - 1. Comply with applicable requirements of Section 03 05 15 - Portland Cement Concrete. Provide class of concrete as indicated.
 - 2. When a dense, high-strength concrete is required, as for stair treads, a fly ash or pozzolanic admixture (ASTM C618), not to exceed 10 percent of the weight of the cement, may be introduced in the mix along with the required plasticizer (ASTM C1017) or water-reducing admixtures (ASTM C494, Type F or Type G).
 - 3. Provide white portland cement and crushed white aggregate where required to achieve colored concrete matching the approved control sample.
 - 4. Coloring material for colored concrete shall be a standard commercial brand of chemically inert mineral oxide coloring material accurately measured by weight in a definite manner for each batch of concrete to produce a consistently even color. Material shall be readily dispersible in water. Color shall be as selected by the Engineer from samples prepared and submitted by the Contractor.
- C. Anchors, Lift Devices, and Accessories: Provide concrete inserts, reglets, anchors, brackets, and fasteners as indicated or required for fabrication and installation work. All items shall be zinc-coated or galvanized in accordance with ASTM A153 or ASTM A123, as applicable. Contractor shall select the lift devices, and shall be responsible for their performance and for any damage resulting from the use of faulty or inferior devices. Lift devices shall not be visible on exposed faces of precast members.
- D. Stair Nosings: Abrasive white bronze with "hot patina" finish. Provide stair nosings of size and profile indicated, with nonslip finish and clean and well-defined cross-hatching and fluting a minimum of 1/16 inch deep. Provide stair nosings with appropriate integral concrete anchors; holes and countersinks for screw-type anchors are not acceptable. Minimum width of tread surface: 4 inches. Width of platform edge safety nosing: 3 inches. Minimum thickness of tread or horizontal portion of nosing: 5/16 inch
 - 1. "Hot patina" finish shall be produced with the following chemicals to achieve a statuary bronze color acceptable to the Engineer; as follows:
 - a. Liver of sulfur
 - b. Ammonium sulfide
 - c. Ferric nitrate

2. Stair nosings for cast-in-place concrete steps are specified in Section 05 50 00 - Metal Fabrications.

E. Dielectric Insulation at Platform Edge:

1. Dielectric insulation membrane shall be as specified in Section 07 13 19 - Modified Bituminous Sheet Waterproofing.
2. Dielectric insulation for dowels shall be terluran resin plastic ribbed or deformed sleeves conforming to the following requirements:
 - a. Tensile strength at yield (ASTM D638): 45 MPa (6.5 ksi)
 - b. Shear modulus (ASTM D638): 900 MPa (130.5 ksi)
 - c. Impact strength, at 23 degrees C (ASTM D1622): No break
 - d. Volume resistivity (ASTM D257): 10^{15} Ω -cm minimum
3. Epoxy grout: Grout for securing plastic sleeves to concrete slab and to precast concrete platform edge units and to secure dowel within plastic sleeve shall be a non-shrink vinyl-ester resin designed to adhere to plastic, steel, and concrete.

F. Noise Abatement Seal:

1. Provide noise abatement seal at juncture of acoustical barrier panels and concrete girders, of size, profile, and configuration indicated. Seal shall be manufactured of dense neoprene meeting requirements of ASTM C542 for durometer A hardness of 75, plus or minus 5, when tested in accordance with ASTM D2240. Color: black.
2. Provide end plugs for each length of seal, one for each end. Plugs shall be manufactured of closed cell neoprene meeting requirements of ASTM C509, Type II.

2.02 FABRICATION

A. Requirements and Standards:

1. Manufacture precast concrete units in accordance with PCI MNL-117, PCI "Architectural Precast Concrete," and applicable requirements of ACI 318/318R, Chapter 16.
2. Forms shall be accurately constructed to produce members to dimension, shape, configuration, and profile indicated. When not otherwise indicated, construct forms to produce smooth concrete.
3. Concrete reinforcement, lifting reinforcement, and concrete inserts and anchorage devices shall be placed and secured against movement as required. Place stair nosings and secure against movement as indicated.
4. Concrete shall be placed and consolidated to shape, configuration, and dimensions indicated.

5. Members shall be moist cured in accordance with curing requirements specified in PCI MNL-117. Minimum curing period for combined initial curing and secondary curing shall be seven days or until the specified strength of concrete is attained.

B. Finishes:

1. Provide finishes for exposed concrete matching approved samples and mock-ups and the approved control samples.
2. When sandblasted finish is indicated, provide "sandblast finish" as specified in ACI 301. Degree of sandblasting shall be as required to provide surface finish matching the approved control sample.
3. For those items not exposed to public view, provide "smooth form finish" as specified in Section 03 35 00 - Concrete Finishing.

- C. Markings:** Provide permanent markings in precast units to identify pick-up points and orientation in the structure, conforming with the markings indicated on Shop Drawings. Imprint the date of casting on each precast unit where it will not show in the finished structure.

2.03 QUALITY CONTROL

- A.** In accordance with Section 01 45 00 - Quality Control, the Contractor-employed independent testing laboratory or agency shall perform such inspections and tests as required to verify compliance with these Specifications. All such inspections and tests shall be conducted at no additional cost to the District.
- B.** Concrete shall be tested for compressive strength as specified in Section 03 05 15 - Portland Cement Concrete. A set of seven cylinders shall be prepared for every ten precast units, or fraction thereof, cast in any one day. Two cylinders shall be tested at 3 days, two cylinders at 7 days, two cylinders at 28 days, and one cylinder shall be retained for further testing as may be required. Cylinders shall be prepared and moist cured in accordance with ASTM C31, and tested in accordance with ASTM C39.

PART 3 - EXECUTION

3.01 EXAMINATION

- A.** Examine all parts of the supporting structure and the conditions under which the precast concrete units are to be erected and installed. Verify the locations of anchors to pre-determine the accuracy of the installation of each member.

3.02 ERECTION/INSTALLATION

- A.** Transport and erect precast concrete units in accordance with PCI MNL-117 and as specified herein.
- B.** Erect precast concrete units and accurately install in place with mechanical hoisting equipment more than adequate for the loads.

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- C. Maintain precast concrete unit in upright position at all times. Handle unit only by indicated lifting devices or cushioned pads, and in a manner that will not overstress or damage the unit.
- D. Erect precast concrete units in accordance with indicated erection tolerances. Comply with erection sequences indicated. Position units to avoid eccentric application of forces, and make complete and uniform contact with bearing surfaces.
- E. Provide anchorage and attachment welding and bolting, as indicated, in accordance with PCI MNL-117, Division VI. Provide touch-up painting of field welds and abraded steel surfaces as specified in Section 09 91 00 - Painting.
- F. At completion, units shall be plumb, level, and square, true to line, with angles and edges parallel with related building lines.
- G. Install noise abatement seals as indicated. Compress at least 15 percent to form a tight seal.
- H. Provide sealant material and application, where indicated, in accordance with applicable requirements of Section 07 90 00 - Joint Protection.

END OF SECTION 03 40 00

SECTION 03 53 00

CONCRETE TOPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Formwork
- B. Reinforcing Steel
- C. Bond Breaker Membrane
- D. Joint Fillers and Sealers
- E. Portland Cement Concrete
- F. Nonslip Aggregate Materials
- G. Concrete Hardener
- H. Concrete Curing Materials

1.02 RELATED SECTION

- A. Cast-in-place concrete is specified in Section 03 30 00 - Cast-In-Place Concrete.
- B. Portland cement concrete is specified in Section 03 05 15 - Portland Cement Concrete.
- C. Finishing and curing of concrete slabs are specified in Section 03 35 00 - Concrete Finishing.

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for concrete topping slabs will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for concrete topping slabs indicated in the Bid Schedule of the Bid Form.
- B. Lump-Sum: If the Bid Schedule indicates a lump-sum for concrete topping slabs, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for concrete topping slabs, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement
 - a. Concrete topping slabs will be measured for payment by the cubic yard, and quantities will be computed, based on the neat lines or pay lines, section profiles, and dimensions shown on the Contract Drawings, without deduction for chamfers, reinforcing steel and embedded items, and openings and recesses having an area of less than two square feet.

- b. Expansion joints will not be measured separately for payment.
 - c. Additional concrete used to replace overcut or for overbreak, or to repair or replace defective work, will not be measured separately for payment.
2. Payment: Concrete topping slabs will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified above.

1.04 REFERENCES

A. American Concrete Institute (ACI):

- 1. ACI 301 Standard Specifications for Structural Concrete
- 2. ACI 117 Standard Specification for Tolerances for Concrete Construction and Materials

B. American Society for Testing and Materials (ASTM):

- 1. ASTM C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixtures in Portland Cement Concrete
- 2. ASTM C1017 Specification for Chemical Admixtures for Use in Producing Flowing Concrete
- 3. ASTM D2178 Specification for Asphalt Glass Felt Used in Roofing and Waterproofing

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings:

- 1. Submit drawings that indicate the locations of all joints in concrete slabs, including construction joints, expansion joints, isolation joints, weakened plane joints and contraction joints. Coordinate with the requirements specified in Section 03 11 00 - Concrete Forming.
- 2. Submit drawings that indicate concrete placement method, sequence, and location.

C. Product Data: Submit manufacturers' product data for nonslip floor ingredients and concrete hardener material.

D. Samples: Submit 1/2-pint sample container of aluminum oxide anti-slip materials for approval. Samples require approval of the Engineer before they may be incorporated in the Work.

1.06 QUALITY ASSURANCE

- A. Specialist Applicator/Installer: Topping slabs shall be installed and finished by a skilled and experienced installer specializing in the installation and finishing of architectural concrete slabs. The Contractor shall submit evidence that the slab installer and finisher is approved by the manufacturer of the nonslip materials.
- B. Floor Finish: "Nonslip finish" in combination with a "troweled finish" or fine "broom finish" conforming to applicable requirements of ACI 301.
- C. Floor Tolerance: "Flat" tolerance conforming to ACI 117.
- D. Cold Joints: Cold joints in concrete will not be permitted unless planned and treated properly as construction joints and submitted for approval as specified under submittals above.
- E. Site Mock-Ups: Refer to Section 01 43 38, Field Samples and Mockups, for mock-up requirements. Provide site mock-up, at least 3 feet by 4 feet in size, of exposed slab finish for the Engineer's review and approval. Provide additional mock-ups, as required, until the desired finish is obtained. Site mock-up requires approval of the Engineer before work may proceed.
- F. Manufacturer's Instructions: Application of the nonslip floor ingredients and concrete hardener material and finishing of the concrete topping slabs shall be in accordance with the written or printed instructions and recommendations of the manufacturer of nonslip floor ingredients and concrete hardener materials.
- G. Manufacturer's Field Services: The Contractor shall engage the manufacturer of the nonslip floor ingredients and concrete hardener materials to provide field services in accordance with the requirements of Section 01 43 00 - Quality Assurance.

PART 2 - PRODUCTS

2.01 TOOLS AND EQUIPMENT

- A. The Contractor shall furnish all materials, tools, equipment, facilities, and services as required for performing the required topping slab placing and finishing work.

2.02 MATERIALS

- A. Formwork: Refer to Section 03 11 00 - Concrete Forming, for requirements.
- B. Reinforcing Steel: Refer to Section 03 20 00 - Concrete Reinforcing, for requirements.
- C. Bond Breaker Membrane: ASTM D2178 asphalt glass felt, Type III - standard ply sheet.
- D. Joint Fillers and Sealers: Refer to Section 03 15 00 - Concrete Accessories, for requirements.
- E. Portland Cement Concrete: Comply with Section 03 05 15 - Portland Cement Concrete, and the following requirements:

1. Topping slab concrete shall have a minimum compressive strength at 28 days of 4,000 psi. Maximum size of aggregate shall be 1 inch, except that 3/8 inch maximum size aggregate shall be used for locations where congestion and other conditions indicate the need for smaller aggregate. Minimum cement content per cubic yard of concrete shall be six and a half 94-pound sacks.
 2. Mix design for topping-slab concrete shall include up to ten percent replacement of the cement content with fly ash (ASTM C618) along with a plasticizing admixture, conforming with ASTM C1017, to provide a dense and plastic concrete mix which will trowel more easily with less surface bleeding of water.
- F. Nonslip Aggregate Material: Crushed ceramically bonded or fused aluminum oxide as specified in ACI 301. Provide 25 pounds per 100 square feet as specified. All aggregate particles shall pass a No. 8 U.S. Standard Sieve, and shall be graded from No. 16 to No. 8 mesh.
- G. Concrete Hardener and Dustproof: Chemical clear liquid hardener which produces a dense, hard, and dustproof concrete surface, manufactured specifically for the intended purpose.
- H. Concrete Curing Materials: Refer to Section 03 35 00 - Concrete Finishing, for requirements.
1. Provide for damp curing only. Curing compound will not be permitted on floors to receive concrete hardener and dustproof.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS:

- A. The requirements of Section 03 30 00 - Cast-In-Place Concrete, Section 03 05 15 - Portland Cement Concrete, and Section 03 35 00 - Concrete Finishing, shall apply to the work of this Section as applicable.

3.02 EXAMINATION

- A. Inspect forms, structural slab surfaces, waterproof membranes and protection board where they occur, reinforcement, and embedded items, and obtain the Engineer's approval thereof before placing concrete. Complete and sign a pour card on the form supplied by the Engineer. The Engineer shall countersign the card prior to commencing the pour.

3.03 PREPARATION

- A. At least 48 hours prior to actual placement, notify the Engineer and nonslip material manufacturer's representative of the intention to deliver and place concrete.
- B. Before placing concrete, broom clean structural slab surfaces and install bond breaker membrane where indicated. Lap edges and ends of asphalt glass felt 6 inches. Small dabs of bituminous cement may be used to hold felt sheets in place during subsequent placing operations.

3.04 PLACING AND FINISHING

- A. Placement and Finishing Standards: Concrete topping slabs shall be placed, consolidated, and finished in accordance with applicable requirements of ACI 301.
- B. Placement:
 - 1. Topping slabs shall be placed and finished monolithically. Strike off and screed slabs to true, plane surfaces at required elevations, and thoroughly compact concrete with vibrators, floats, and tampers to force coarse aggregate below the surface. Finish slab within four hours of concrete placement.
 - 2. Whether indicated or not, in areas where drains occur, slope finished slab to drains. Slope shall be a minimum of 1/8 inch per foot unless otherwise indicated.
- C. Finishes:
 - 1. Topping slabs shall receive a "troweled finish" or fine "broom finish" in combination with a "nonslip finish," as selected by the Engineer from Contractor-prepared mock-ups, with "flat" tolerance, as specified in ACI 117.
 - 2. Application of the nonslip material and finishing of the topping slabs shall conform with the nonslip material manufacturer's application instructions and recommendations.

3.05 CURING

- A. Curing of concrete topping slabs shall conform with applicable requirements of ACI 301, except that the duration of the curing period shall be ten days minimum.
- B. Provide damp curing only as specified in Section 03 35 00 - Concrete Finishing. Curing compounds will not be permitted.

3.06 APPLICATION OF CONCRETE HARDENER

- A. Allow slab surfaces to cure and dry a minimum period of 28 days before applying hardener/dustproofer material. Slab surfaces shall be clean and dry at the time hardener/dustproofer material is applied.
- B. Apply clear liquid hardener/dustproofer compound to slab surfaces, after the damp-curing and drying period, in accordance with the manufacturer's application instructions. Rate of application and number of coats shall conform with the manufacturer's instructions and recommendations.

3.07 PROTECTION

- A. Protect exposed concrete slab surfaces as required to prevent damage from impact or stains.
- B. Protect fresh concrete from drying winds, rain, damage, or soiling.
- C. Refer to Section 03 30 00 - Cast-In-Place Concrete, Article 3.09, for additional requirements.

CONCRETE TOPPING SLABS

END OF SECTION 03 53 00

SECTION 03 61 11

NON-SHRINK GROUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cementitious Grout
- B. Epoxy Grout
- C. Epoxy Adhesive

1.02 RELATED SECTIONS

- B. Grout for prestressed concrete is specified in Section 03 05 18 - Prestressed Concrete.
- C. Masonry grout for filling cells of unit masonry is specified in Section 04 22 00 - Concrete Unit Masonry.
- D. Grout for filling and finishing joints of ceramic tile and cut stone is specified in applicable sections under Division 9 - Finishes.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Grout work will not be measured separately for payment.
- B. Payment: Grout work will be paid for as part of the indicated Contract price for the work or structure in which the grout is used.

1.04 DEFINITION:

- A. For the purpose of these Specifications, "non-shrink grout" shall be defined as a high-strength mortar or grout which does not shrink in the plastic state, is dimensionally stable in the hardened state, and bonds permanently to a clean metal baseplate and concrete substrate.

1.05 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 503.2 Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
 - 2. ASTM C157 Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete

NON-SHRINK GROUT

3. ASTM C579 Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
4. ASTM C827 Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
5. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
6. ASTM C1090 Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout
7. ASTM C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrinkable)

C. U. S. Army Corps of Engineers, Concrete Research Division (CRD):

1. CRD-C620 Standard Method of Sampling Fresh Grout
2. CRD-C621 Non-shrink Grout

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit manufacturer's product data and installation instructions.
- C. Certification: Submit certificates of compliance or laboratory test reports which indicate the following:
 1. Materials used in the grout are free from metallic components and corrosion-producing elements.
 2. Materials meet specified shrinkage and compressive strength requirements.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Handle grout the same as concrete with regard to temperature and curing, as specified in Section 03 30 00 - Cast-In-Place Concrete, Section 03 05 18, Portland Cement Concrete, and Section 03 35 00 - Concrete Finishing.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cementitious Grout: Provide non-shrink, non-metallic, non-corrosive cement-based grout conforming to the following requirements:
 1. Applicable Standards: ASTM C1107 and CRD-C621.

NON-SHRINK GROUT

2. Grout shall be manufactured specifically for use in supporting heavy loads (loads in excess of 300 pounds per square foot concentrated load or 100 pounds per square foot uniform load). Grout: ASTM C1107, Grade A, B, or C, as appropriate for the condition or circumstance.
 3. Shrinkage at 28 days: No shrinkage before hardening (0.00 shrinkage when tested in accordance with ASTM C827); no shrinkage after hardening (0.00 shrinkage when tested in accordance with CRD-C621).
 4. Compressive strength, minimum:
 - a. At one day: 1000 psi
 - b. At three days: 2500 psi
 - c. At seven days: 3500 psi
 - d. At 28 days: 5000 psi
 5. Initial setting time, after addition of water: approximately one hour at 70 degrees F.
 6. Provide nonsag trowelability or flowability as necessary for the particular application.
- B. Water: Clean and potable, free of impurities detrimental to grout.
- C. Epoxy Grout: Provide non-shrink, non-metallic, non-corrosive epoxy grout conforming to the following requirements:
1. Grout shall be manufactured specifically for use in supporting heavy loads.
 2. Shrinkage at 28 days: None (0.00 shrinkage when tested in accordance with ASTM C827 modified procedure) with a minimum effective bearing area (EBA) of 95 percent coverage of the tested base plate.
 3. Compressive strength, minimum: 10,000 psi at seven days, when tested in accordance with ASTM C579.
 4. Initial setting time: Approximately one hour at 70 degrees F.
 5. Provide flowable consistency as necessary for the particular application.
 6. Epoxy grouts which are volatile and which give off noxious fumes are not acceptable.
- D. Epoxy Adhesive: ASTM C881, Type V, epoxy-based bonding agent.

2.02 MIXING

- A. Mix grout ingredients for both cementitious grout and epoxy grout in accordance with the respective manufacturer's mixing instructions and recommendations. Mix grout materials in proper mechanical mixers.
- B. Mix grout as close to work area as possible.

2.03 SOURCE QUALITY CONTROL

- A. Inspections and Tests: Perform visual inspections and shrinkage tests using an appropriate independent testing laboratory, and strength tests as necessary to verify performance requirements of grout. Sampling and testing of grout shall conform with applicable ASTM or CRD-C620 requirements.
- B. Visual Inspections: Perform visual inspection of the grout mixing and placement to determine and verify that grout consistency, slump, and stiffness are appropriate and proper for the location and type of installation.
- C. Shrinkage Tests:
1. Cementitious Grout: Grout shall meet the following performance requirements:
 - a. Expansion: 0.4 percent maximum at 3, 14, and 28 days. Grout shall exhibit no displacement when tested in accordance with ASTM C157.
 - b. Shrinkage: None (0.00 shrinkage at 28 days when tested in accordance with ASTM C827 and ASTM C1090). There shall be no vertical volume shrinkage of grout in the plastic or hardened stage at any time.
 2. Epoxy Grout: Grout shall meet the following performance requirements:
 - a. Expansion: Grout shall exhibit no displacement when tested in accordance with ASTM C827 and ASTM C157, modified procedures.
 - b. Shrinkage: None (0.00 shrinkage when tested in accordance with ASTM C827, modified procedure; specific gravity of indicator ball will be changed to approximately 1.0).
 - c. Effective Bearing Area: 95 percent minimum coverage of the tested base plate.
- D. Strength Tests: Compressive strength of grout shall meet the following requirements:
1. Cementitious Grout: 5,000 psi minimum at 28 days when tested in accordance with ASTM C109.
 2. Epoxy Grout: 10,000 psi minimum at 7 days when tested in accordance with ASTM C579.

PART 3 - EXECUTION**3.01 SURFACE PREPARATION**

- A. Concrete surfaces to receive grout shall be prepared by chipping, sandblasting, water blasting, or other accepted methods to remove defective concrete, laitance, dirt, oil, grease, and other foreign matter to achieve sound, clean concrete surfaces. Lightly roughen concrete for bond, but not enough to interfere with proper placement of grout.
- B. Cover concrete areas with protective waterproof covering until ready to place grout.

NON-SHRINK GROUT

- C. Remove foreign matter from steel surfaces to be in contact with grout. Clean contact steel surfaces as necessary by wire brushing and wiping dust clean.
- D. Align and level components to be grouted, and maintain in final position until grout placement is complete and accepted.
- E. Install forms for grout around the column base plates and other spaces to be grouted. The tops of such forms shall be one inch above the surfaces to be grouted.
- F. Remove protective waterproof covering and clean contaminated surfaces immediately before grouting.
- G. Provide air-relief holes in large baseplates and in baseplates where underneath obstructions may cause air entrapment.
- H. Saturate concrete surfaces with clean water, and remove excess water immediately before grouting.
- I. Where necessary or appropriate for better bond, epoxy adhesive may be applied to clean, dry substrate surfaces in accordance with applicable requirements of ACI 503.2.

3.02 PLACING GROUT

- A. Place grout in accordance with the respective manufacturer's installation instructions and recommendations. Pour grout from one side only until grout rises at least one inch above the plate on opposite side of said plate. Strapping and plunging or other recommended method may be used to force grout to flow under the entire area.
- B. Neatly trowel edges of grout base, tapered at an angle of 60 degrees when measured from the horizontal, or as indicated. Provide dry-pack cementitious grout where additional grout is required for shoulders.
- C. Do not remove leveling shims for at least 48 hours after grout has been placed.
- D. After shims have been removed, if used, fill voids with grout, packing the material with a suitable tool.
- E. Do not use grout which has begun to set or if more than one hour has elapsed after initial mixing.

3.03 CURING

- A. Cementitious grout shall be cured the same as specified for concrete in Section 03 35 00 - Concrete Finishing.
- B. Epoxy grout shall be cured as recommended by the grout manufacturer.

END OF SECTION 03 61 11

BART Facilities Standards (BFS)

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5.4 Division 4

Masonry

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SECTION 04 01 20

UNIT MASONRY RESTORATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cutting and Chipping
- B. Repairing of Cracks
- C. Restoration Work
- D. Removal of Paint
- E. Cleaning

1.02 RELATED SECTIONS

- A. Coordinate the Work of this Section with the Work of other Sections specifying remedial work, corrective measures, and restoration work, including Section 01 71 23 - Field Engineering, Section 01 74 14 - Cleaning, and Section 02 41 19 - Selective Structure Demolition.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Repair and restoration of existing masonry will be measured for payment by the lump-sum method, acceptably performed and completed.
- B. Payment: Repair and restoration of existing masonry will be paid for at the indicated Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C881 Specification for Epoxy-Resin-Base Bonding System for Concrete
 - 2. ASTM C928 Specification for Packaged, Dry Rapid-Hardening Cementitious Materials for Concrete Repairs
 - 3. ASTM C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

1.05 DEFINITIONS

- A. The station or building involved in this work will be in continuous operation during the construction period. This will require that the Contractor plan the Work carefully to work around unavoidable obstacles in the prosecution of the Work. It will require further that the Contractor

complete some new construction facilities required in the renovation work before proceeding with the masonry restoration work.

- B. Provide such additional temporary facilities as may be required to facilitate continuous, unobstructed station or building operations during transitional construction work.

1.06 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following code requirements:

California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 34, "Existing Structures."

1.07 QUALITY ASSURANCE

- A. Repair and restoration of existing masonry surfaces shall be performed by a skilled and experienced subcontractor specializing in the restoration of masonry with at least five years experience in the type of work involved.
- B. Repair and restoration of existing stone and unit masonry work shall achieve security, strength, and weather protection, as applicable and required, and shall preserve the integrity and continuity of fire-rated assemblies.
- C. Repair and restoration of existing masonry work shall successfully duplicate undisturbed adjacent finishes, colors, textures, and profiles. Where there is a dispute as to whether or not duplication is successful or has been achieved to a reasonable degree, the Engineer's judgment shall be final.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. Requirements: Provide all materials, equipment, tools, appurtenances, facilities, and services as required for performing and completing all repair and restoration of existing stone and unit masonry as indicated.
- B. Equipment, Tools, and Materials: Provide appropriate and proper equipment, tools, and materials for the chipping and air-pressure cleaning of cracks in masonry, for pressure injection grouting of cracks in mortar joints, for sandblasting or water-blasting of masonry surfaces, and for hose cleaning of masonry.
- C. Stone and Unit Masonry Materials: Where cut stone or concrete masonry units are damaged and require replacement, provide new stone or masonry units that match exactly the species, color, and texture of adjacent masonry surfaces. Replacement cut stone and concrete masonry units require approval of the Engineer before they may be used in the work.
- D. Mortar Bonding Agent: Adhesive for the bonding of new mortar and grout to existing masonry and mortar shall be an epoxy adhesive meeting requirement of ASTM C881, of type required for the conditions.

- E. Mortar Repair Materials:
1. Mortar: Mortar for joints and tuckpointing shall be an epoxy mortar, polymer-fortified mortar, or similar high-strength bonding mortar conforming with ASTM C928. Minimum compressive strength at 28 days shall be 2,500 psi.
 2. Sand: Sand shall be a clean, washed, kiln-dried, fine sand, all passing a U.S. Standard No. 16 sieve.
- F. Grout: Grout for pressure-injection grouting shall be a high-strength, nonshrink, cementitious, adhesive grout conforming with ASTM C1107, Grade C, or a high-strength, non-shrink, manufactured epoxy adhesive grout. Minimum compressive strength at 28 days shall be 4,000 psi.
- G. Cleaning Agent: Mild solution of hydrochloric acid or muriatic acid, for washing of stubborn stains on masonry.

PART 3 - EXECUTION

3.01 REQUIREMENTS

- A. Perform cutting, chipping, patching/restoring work, and cleaning in a manner to prevent damage to other work, and as required to return exterior building surfaces to essentially their original condition and configuration.
- B. Major cracks shall be repaired and filled by pressure-injection grouting. All other cracks shall be repaired in the manner most appropriate and as required for weatherproofing or waterproofing the building or structure.
- C. Do not cut or alter structural members when not indicated without prior approval of the Engineer.
- D. Finish or refinish as required to match adjacent finishes.

3.02 CUTTING AND CHIPPING

- A. Cutting and chipping work shall be neatly and accurately performed with proper tools and equipment. Cuts shall be of minimum size required for the work. Check the locations carefully of existing steel reinforcement before cutting or chipping.
- B. Existing work to remain shall be properly protected to prevent damage from cutting and chipping operations.

3.03 REPAIRING OF CRACKS

- A. Cracks shall be repaired and filled with grout by the pressure-injection process. Masonry joint cracks shall be mapped, and the injection shall be on center-to-center spacings as necessary to achieve proper structural bonding. Replace all cut stone and masonry units that have cracks across the face.

- B. Adhesive material shall be mixed with grout in proportion necessary to provide structural bonding of concrete. Grout material shall be inserted into cracks by pressure-injection grouting in accordance with the manufacturer's installation instructions and recommendations.
- C. Minor cracks too small for injection grouting shall be repaired as specified in Article 3.04 for restoration work.
- D. Small holes, cracks, and other imperfections to be painted shall be suitably primed and patched with a compound recommended by the manufacturer of the paint to be applied to these surfaces as specified in Section 09 91 00 - Painting.

3.04 RESTORATION WORK

- A. Preparation of Existing Surfaces: Where masonry is cracked or spalled, cut or chip out to solid surface. Use power wire brush and high pressure air to clean masonry of dirt, dust, and loose particles. Clean exposed reinforcing bars with power wire brushing to remove all visible corrosion.
- B. Repairing of Masonry:
 - 1. Repairing and patching of existing masonry surfaces and joints shall be expertly performed with specified adhesive, mortar, and grout materials. At completion, patched surfaces shall match adjacent existing surfaces as closely as possible.
 - 2. Mortar bonding agent, mortar, and grout shall be applied or installed where indicated, or where otherwise required, in accordance with the manufacturer's instructions and recommendations.
 - 3. Where necessary to build out cut, spalled, or chipped masonry surfaces, mix mortar bonding agent, mortar, and sand into a special mortar, and apply in layers as required to fill out or build up surfaces. Float, trowel, or texture surfaces to match adjacent existing surfaces.
 - 4. Where indicated or required to replace existing, damaged cut stone or concrete masonry units, expertly cut out damaged units with masonry saw or cutting wheel. Clean out all loose particles and dust with air-pressure cleaning. Then install new units to match adjacent existing masonry surfaces as closely as possible, including joint treatment.
- C. Tuckpointing:
 - 1. Joints of cut stone and concrete unit masonry shall be routed out and tuckpointed as herein specified. Only such tuckpointing shall be performed as required to put all joints of the building in good repair.
 - 2. Faulty joints to be tuckpointed shall be routed out the full width of the existing joint with a machine masonry cutting wheel to a minimum depth of 3/8 inch into the existing mortar. Newly routed joints shall be washed clean before tuckpointing.
 - 3. Tuckpointing mortar shall be the repair mortar specified in Article 2.01.E herein.

3.05 REMOVAL OF PAINT

- A. Where removal of existing paint film is required for restoration of masonry surfaces, existing painted masonry surfaces shall be sandblasted by the "wet" sandblast method to remove all such paint film. Surfaces not to be sandblasted shall be properly masked and otherwise protected to preclude any damage to these surfaces.
- B. Wet sandblasted surfaces shall be thoroughly dry or dried before painting work is started as specified in Section 09 91 00 - Painting.

3.06 CLEANING

- A. Where existing masonry surfaces are indicated to be cleaned or washed to remove dirt, dust, and stains, such surfaces shall be washed clean to an even and uniform effect, free of stains and blemishes. Include adjacent cornices, ledges, and masonry ornaments. Method of cleaning (e.g. high-pressure water, steam cleaning, or diluted acid cleaning) are subject to approval by the Engineer.
- B. All adjacent glass areas shall be cleaned after washing of masonry surfaces.
- C. Replace any glass damaged by the cleaning operations.

END OF SECTION 04 01 20

BART Facilities Standards (BFS)

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SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Concrete Masonry Units
- B. Epoxy Bonding Adhesive
- C. Control Joint Materials
- D. Joint Reinforcement
- E. Reinforcing Steel
- F. Precast Beams, Lintels and Copings
- G. Mortar
- H. Grout
- I. Surface Sealer

1.02 RELATED SECTIONS

- A. Reinforcing steel for concrete and connecting dowels for grouted unit masonry are specified in Section 03 20 00 - Concrete Reinforcing.

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for concrete unit masonry will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for concrete unit masonry indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for concrete unit masonry, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Price: If the Bid Schedule indicates a unit price for concrete unit masonry, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Concrete unit masonry will be measured by the square foot or square yard for each type of masonry unit and thickness of wall. No deductions will be made for openings less than 64 inches square.
 - b. Vertical and horizontal steel reinforcement, control joints, mortar, grout, anchors, ties, masonry cleaning, sealer, and miscellaneous accessories will not

be measured separately for payment; such items will be considered incidental to, and included with, the concrete unit masonry work.

2. Payment: Concrete unit masonry will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.04 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 530 Building Code Requirements for Masonry Structures
2. ACI 530.1 Specifications for Masonry Structures

B. American Society for Testing and Materials (ASTM):

1. ASTM C33 Specification for Concrete Aggregates
2. ASTM C90 Specification for Hollow Load-Bearing Concrete Masonry Units
3. ASTM C91 Specification for Masonry Cement
4. ASTM C94 Specification for Ready-Mixed Concrete
5. ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
6. ASTM C143 Test Method for Slump of Hydraulic Cement Concrete
7. ASTM C144 Specification for Aggregate for Masonry Mortar
8. ASTM C150 Specification for Portland Cement
9. ASTM C207 Specification for Hydrated Lime for Masonry Purposes
10. ASTM C270 Specification for Mortar for Unit Masonry
11. ASTM C404 Specification for Aggregates for Masonry Grout
12. ASTM C476 Specification for Grout Masonry
13. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
14. ASTM C979 Specification for Pigments for Integrally Colored Concrete
15. ASTM C1006 Test Method for Splitting Tensile Strength of Masonry Units
16. ASTM C1019 Test Method for Sampling and Testing Grout

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:

California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 21, "Masonry," and Chapter 21A, "Masonry."

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: When not indicated in sufficient detail or definition, submit detailed drawings of unit masonry, showing type of mortar joints, bond pattern, reinforcing steel, connecting dowels, joint reinforcement, grouted cells, and control joints.
- C. Product Data: Submit manufacturer's product data for block, including available color range, epoxy adhesive, joint reinforcement, and control-joint materials, along with installation instructions where applicable.
- D. Samples: Submit full-size sample of block and samples of colored mortar for approval. Block and colored joint mortar require approval of the Engineer before they may be used in the concrete masonry work.
- E. Certificates: Submit certification stating that concrete masonry units meet specification requirements and that masonry units conform with the special strength requirements of these Specifications. Each certificate shall be signed by the masonry unit manufacturer and shall contain the name of the manufacturer, the project location, and the quantity and dates of shipment or delivery to which the certificate applies.

1.07 QUALITY ASSURANCE

- A. Concrete unit masonry work shall conform with applicable requirements of the California Building Code, Chapters 21 and 21A, ACI 530, and ACI 530.1, except as modified in these Specifications.
- B. Construction tolerances for concrete unit masonry shall conform with ACI 530.1.
- C. Refer to Section 01 45 00 - Quality Control, for additional requirements and procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete Masonry Units (Concrete Block):

CONCRETE UNIT MASONRY

1. Concrete masonry units shall be of modular face dimensions and thicknesses indicated. Furnish necessary shapes and sizes, bond-beam units, and corner units as required to satisfy conditions indicated. Include half-size units where indicated or required.
2. Concrete masonry units shall be hollow load-bearing units conforming to ASTM C90, and shall be No. 1 Normal Weight, No. 2 Medium Weight, or No. 3 Light Weight, as applicable, Type I - Moisture Controlled Units. Units shall have a maximum linear shrinkage of 0.06 percent, and shall meet water absorption requirements of ASTM C90.
3. Concrete masonry units shall be normal cement-colored units with standard face surfaces. Cinders or ingredients that might stain paint finishes will not be permitted in the manufacture of concrete masonry units.

B. Split-Face Concrete Masonry Units:

1. Split-face concrete masonry units shall conform with ASTM C90, as specified above for concrete masonry units, of modular face dimensions and thicknesses indicated. Face of units shall have special surface texture split-face, scored to dimensional module indicated. Minimum strength requirements shall conform with foregoing specified concrete masonry units.
2. Block shall have integral color as selected by the Engineer from manufacturer's standards.

C. Cement: ASTM C150, Type I or Type II Portland cement, low alkali. Provide white cement when required to achieve the mortar color selected by the Engineer. ASTM C91, Type S, masonry cement may be used together with ASTM C150 portland cement as herein specified under "Mortar."

D. Lime: ASTM C207, hydrated, Type S.

E. Mortar Sand: ASTM C144, natural sand, clean and graded.

F. Mortar Coloring Pigment: ASTM C979, manufactured, inert mineral oxides in color or colors as selected and approved by the Engineer.

G. Grout Aggregate: ASTM C33 or ASTM C404, clean and graded concrete aggregates, proportioned by volume as follows: 3 parts fine and graded concrete aggregate to 2 parts of graded 3/8-inch maximum size coarse aggregate.

H. Water: Fresh, clean and potable, and free from such amounts of mineral and organic substances as would adversely affect the hardening of cement mortar.

I. Epoxy Bonding Adhesive: Adhesive for bonding of mortar bed to concrete slabs shall be an epoxy-based bonding agent conforming to ASTM C881, Type V, tinted to show by visual inspection where it has been applied.

J. Control Joint Materials: Conform with requirements of ACI 530.1.

K. Joint Reinforcement: No. 9 gage ladder or truss type steel wire conforming to ACI 530.1.

- L. Reinforcing Steel: Provide reinforcing steel for grouted block masonry under this Section in accordance with the requirements of Section 03 20 00 - Concrete Reinforcing, and ACI 530.1.
- M. Precast Beams, Lintels, and Copings: Precast concrete of configuration indicated, conforming to requirements of Section 03 40 00 - Precast Concrete, and ACI 530.1. Provide exposed surfaces with light sand-blasted finish matching finish of masonry units as closely as possible.

2.02 MORTAR

- A. Mortar Type and Mixing Requirements:
 1. Mortar for grouted unit masonry shall be Type S mortar in accordance with the California Building Code, Chapter 21 and 21A, ACI 530.1, and ASTM C270, with a minimum compressive strength at 28 days of 1,500 psi. A minimum of two 94-pound sacks of portland cement (ASTM C150) shall be provided per cubic yard of mortar when using ASTM C91 masonry cement.
 2. The use of an admixture for the purpose of reducing water content in mortar will be permitted, provided the strength of the mortar is not reduced.
 3. Mortar shall be job mixed and, in lieu of specific requirements specified herein, shall conform with ASTM C270, including measurement, mixing, proportioning, and water retention.
 4. Accurately measure mortar ingredients and mix a minimum of three minutes after water has been added, in a mechanical batch mixer, using sufficient water to produce a workable and plastic consistency. Hand mixing will be permitted for small quantities only.
 5. Use mortar within 2-1/2 hours after mixing when air temperature is 80 degrees or higher, and within 3-1/2 hours when air temperature is below 80 degrees. Discard any mortar that has been mixed longer or that has begun to set. If necessary, mortar may be retempered within this time limit, by replacing only water lost due to evaporation and by thorough remixing.
- B. Colored Joint Mortar: Provide colored mortar for exposed masonry joints where indicated. Color shall be as approved by the Engineer from samples prepared and submitted by the Contractor. Pigment amount for selected color and mixing of colored mortar shall conform with the pigment manufacturer's instructions.

2.03 GROUT

- A. Grout shall be Coarse Grout, as defined in ASTM C476, with a minimum compressive strength at 28 days of 2,000 psi, and shall be proportioned by volume in accordance with ACI 530.1.
- B. Grout mix shall be designed in accordance with ASTM C94 for manufacturer designed mixes, and for handling by an approved grout pump. Slump shall be 10 inches.

- C. The use of an admixture for the purpose of reducing water content in grout and adding flowability will be permitted, provided the strength of the grout is not reduced. Admixture shall be added to the mix as recommended by the manufacturer for the purpose intended.

2.04 SURFACE SEALER

- A. Provide a water-based, VOC-compliant, clear, penetrating water-repellent sealer, designed to provide long-term protection against water absorption, for exterior concrete unit masonry surfaces. Submit sealer performance data and VOC compliance verification for approval.

PART 3 - EXECUTION

3.01 LAYING CONCRETE MASONRY UNITS

- A. Installation Standards: Comply with applicable requirements of ACI 530.1.
- B. Requirements: Construct concrete unit masonry to dimensions indicated. Concrete masonry units shall be dry when laid. Avoid using less than half-size units in exposed locations. Do not expose cells on any surface. Where concealed, spaces not large enough for full or half-size units may be filled with concrete building brick or mortar.
- C. Work Quality:
 1. Masonry work shall be performed by skilled and experienced masons. Erect walls plumb and true to line, with courses level and joints uniform in width, using specified mortar. Vertical joints shall line up plumb in exposed walls.
 2. Concrete masonry units shall be sound and free of cracks and surface defects. Handle units carefully to avoid chipping and breaking. Do not substitute cut units where special shapes are available.
 3. Where steel beams or joists frame into masonry, fill spaces with mortar and finish off flush with masonry surface, neatly pointed around steel. Where pipes and ducts penetrate masonry, point neatly and accurately around pipes and ducts.
- D. Cutting of Units: Cutting of units shall be kept to a minimum. Perform cutting accurately to accommodate items passing through or embedded in masonry, to meet surfaces that masonry abuts, and to fit various conditions. Cutting of masonry units shall be performed with a power-driven masonry saw. Rub cuts smooth and even with carborundum or emery stone.
- E. Bedding and Jointing:
 1. Use full mortar bed and coverage on horizontal and vertical face shells of hollow units. Webs also shall be bedded in mortar. Shove vertical joints tight.
 2. Top surfaces of concrete foundations or other bed joints shall be clean concrete with aggregate exposed before start of laying. Tops of foundations shall be roughened and cleaned to remove laitance for exposing aggregates in the concrete. Where block is to be laid on slabs, bed joints shall be roughened and cleaned, and an epoxy bonding adhesive shall be applied before laying first course of block.

- F. Joint Reinforcement: Provide ladder or truss type joint reinforcement, spaced a maximum of 16 inches on center vertically. Place in accordance with ACI 530.1, fully embedded in mortar.
- G. Bond Pattern: Lay masonry units in stretcher bond or running bond, unless otherwise indicated.
- H. Alignment of Vertical Cells: Masonry shall be built to preserve the unobstructed vertical continuity of the cells. The vertical alignment shall be sufficient to maintain a clear, unobstructed vertical flue, measuring not less than 3 inches in all directions for grouted masonry.
- I. Cleanouts: Cleanout openings shall be provided at the bottoms of cells to be filled with grout. Mortar droppings shall be removed from cells, and cleanouts shall be sealed after inspection and before grout placement.
- J. Pipe Chases: Chases and recesses for conduits, pipes, and ducts shall be formed as masonry work is constructed. Do not enclose conduit runs until complete and approved, or piping until it has been tested and approved. Make such chases and recesses plumb, with inside joints struck flush, and the interiors kept free of obstructions and cleaned-out upon completion.
- K. Anchorage and Embedded Items:
 - 1. Set accurately in place and bond into masonry, as the masonry work progresses, bolts, straps, hangers, sleeves, anchors, inserts, frames for doors and windows, and any other anchorage items or attachments as indicated. Provide suitable recesses for cabinets, junction boxes, panels, and other items to be built into masonry. Consult with other trades in advance so their work can be accommodated at correct locations, as masonry work progresses, to avoid cutting and patching.
 - 2. Cells containing anchorage or built-in items shall be grouted solid.
 - 3. Where masonry is laid against concrete or metal, the joints between shall be filled with mortar as each course is laid.
- L. Joint Finishing:
 - 1. Pack mortar tightly in joints and wipe wall faces clean as work progresses. Unless otherwise indicated, exposed joints shall be densely tooled concave and smooth with joint tool when mortar is thumbprint hard.
 - 2. Joints in work concealed by other finishes shall be cut or struck off flush. Rake out joints around metal frames in openings 3/4-inch deep for sealant to be applied under Section 07 90 00 - Joint Protection.
 - 3. Nominal joint size, both vertical and horizontal, shall be 3/8 inch.
- M. Joining Work: Step back unfinished work for joining with new work. Toothing shall be resorted to only where unavoidable. Before starting or resuming work, remove loose mortar and foreign matter from work in place, and clean all surfaces of work to be joined.

- N. Control Joints: Provide control joints where indicated. Comply with ACI 530.1.
- O. Precast Beams, Lintels, and Copings: Provide precast concrete units where indicated. Comply with ACI 530.1, and applicable requirements of Section 03 40 00 - Precast Concrete.

3.02 REINFORCING STEEL

- A. Provide reinforcing steel for grouted masonry as indicated. Comply with applicable requirements of ACI 530.1.
- B. Vertical reinforcing bars shall be placed prior to laying the wall and shall be held in place by standard reinforcing supports. Vertical bars shall be held in position at top and bottom and at intervals not exceeding 190 diameters of the reinforcement or 9 feet, whichever is less. Vertical reinforcing steel shall have a minimum clearance of 1 inch from the masonry.
- C. When a foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six vertical. Dowels shall be grouted into a core in vertical alignment, even though it is an adjacent cell to the vertical wall reinforcing.
- D. Horizontal reinforcing bars for bond-beam or channel units shall be laid on the webs of the units in continuous masonry courses, and shall be solidly embedded in mortar and grout. Horizontal bars shall be tied to vertical bars as the block work progresses. Placing of horizontal reinforcing bars in mortar joints will not be permitted.
- E. Reinforcing bars shall be straight except for bends around corners and where bends or hooks are indicated.
- F. Reinforcing steel shall be lapped in accordance with ACI 530, Chapter 8. Length of lapped splices shall be not less than 30 bar diameters for bars in compression and 40 bar diameters for bars in tension. Lapped splice bars shall be wire-tied together for the entire length of the splice.

3.03 GROUTING

- A. Grouting Requirements:
 - 1. Cells of concrete unit masonry shall be filled solid with grout where indicated. Cells containing reinforcement and anchorage or built-in items shall be filled solid with grout. Comply with applicable requirements of ACI 530.1.
 - 2. Spaces around metal frames and other built-in items shall be filled solid with grout or mortar.
 - 3. Reinforcing steel shall be secured in place, inspected, and approved before grouting starts.
 - 4. Mortar droppings and projections shall be kept out of the grout space. Webs, wythes, and reinforcement shall be cleaned of mortar droppings before grout is placed.
 - 5. Grout shall be rodded, puddled, or vibrated in place.

6. Cells shall be filled solid with grout, and pours shall be stopped 1-1/2 inches below the top of a course to form a key at pour joints.
7. Grouting of beams over openings shall be performed in one continuous operation. Tops of unfilled cell columns under a horizontal masonry beam shall be covered with metal lath, or special units shall be used to confine the grout fill to the beam section.

B. Grout Construction:

1. Grout construction, including grout placement and consolidation, shall conform with applicable requirements of ACI 530.1, except as otherwise specified herein.
2. Grout shall be placed in lifts not to exceed 4 feet, with a waiting period of one hour between lifts. The full height of the wall or masonry section shall be placed in one day.
3. Rod or vibrate grout thoroughly the entire height of the pour when first placed to push grout into all spaces and interstices. After the waiting period of an hour, place second lift and rod or vibrate the pour again to penetrate not more than half way into the first lift. Repeat this placing operation, waiting period, and consolidating technique until the top is reached. The top pour or lift shall likewise be reconsolidated after waiting period to allow excess water to be absorbed and escape.

3.04 REPAIRING AND POINTING

- A. Upon completion of the work, carefully examine masonry surfaces and cut out and replace broken or defective units. Rake out defective mortar joints and repoint.

3.05 CLEANING

- A. After erection and pointing, masonry shall be cleaned down with stiff brushes and water, followed by a thorough rinsing with clean water. All mortar deposits, stains, or other foreign matter shall be removed from masonry surfaces.
- B. After masonry has been fully grouted, laitance and stains that have percolated through the blocks and mortar joints shall be hosed off with water under pressure.
- C. The Engineer may direct that certain masonry surfaces or areas be cleaned with a commercial masonry cleaner manufactured for the purpose, in which case follow the instructions or recommendations of the masonry-cleaner manufacturer for cleaning method.

3.06 CURING

- A. Masonry work and top of the grout pour shall be damp-cured for at least 7 days to prevent too rapid drying during hot or drying weather, and drying winds.
- B. Walls shall be kept moist or damp with water from a fogging nozzle, but shall not be wet to the point that free water drops from the surface.

3.07 SEALER APPLICATION

- A. Preparation: Surfaces receiving sealer shall be thoroughly dry and free of all construction stains, surface dirt, and efflorescence.
- B. Application: Apply sealer, where concrete unit masonry is exposed to the weather, in accordance with the manufacturer's application instructions and recommendations.

3.08 FIELD QUALITY CONTROL

- A. Slump Tests: Perform slump tests of grout during grout placement in accordance with ASTM C1019 and ASTM C143.
- B. Strength Tests: Provide laboratory tests conforming to the following requirements:
 - 1. Concrete Masonry Units: Tensile strength tests shall be performed in accordance with ASTM C1006. Three units shall be tested for each 2,000 square feet of wall area.
 - 2. Mortar: Compressive strength tests shall be performed in accordance with ASTM C109. Three cubes shall be tested for each 2,000 square feet of wall area, one at seven days and two at 28 days.
 - 3. Grout: Compressive strength tests shall be performed in accordance with ASTM C1019. Three square prisms shall be tested for each 2,000 square feet, or fraction thereof, of wall area.
- C. Test Reports: Submit certified copies of all test results to the Engineer for record purposes.
- D. Rejection of Masonry; Repair and Replacement: The Engineer shall have authority to reject concrete masonry work that does not meet specification requirements, and to require repair or replacement as necessary to complete the concrete masonry work.

3.09 ACCEPTANCE OF STRUCTURE

- A. Acceptance of the completed concrete masonry work requires conformance with the dimensional tolerances, appearance, and strengths specified in these Specifications and in ACI 530 and ACI 530.1.

END OF SECTION 04 22 00

5.5 Division 5

Metals

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SECTION 05 05 22

METAL WELDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Welding Rod/Electrodes
- B. Stud Shear Connectors
- C. Shop Welding
- D. Inspections and Tests by the Contractor
- E. Inspections and Tests by the Engineer

1.02 RELATED SECTIONS

- A. Welding of H-piles and pipe shells for piles is specified in Section 31 62 00 - Driven Piles.
- B. Welding of reinforcing steel for concrete is specified in Section 03 20 00 - Concrete Reinforcing.
- C. Welding and brazing of piping for plumbing and mechanical systems are specified under the applicable Sections.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Welding and welds will not be measured separately for payment.
- B. Payment: Welding and welds, including inspections and tests to be performed by the Contractor, will be paid for as part of the indicated Contract unit prices for the associated steel and metal work.

1.04 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. AISC Northridge Interim Observations and Recommendation on
Technical Bulletin No. 2 Steel Moment-Resisting Frames, October 1994
- B. American Society for Nondestructive Testing (ASNT):
 - 1. SNT-TC-1A Recommended Practice
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM E94 Guide for Radiographic Testing
 - 2. ASTM E142 Method for Controlling Quality of Radiographic Testing

METAL WELDING

3. ASTM E164 Practice for Ultrasonic Contact Examination of Weldments
 4. ASTM E165 Test Method for Liquid Penetrant Inspection Method
 5. ASTM E709 Guide for Magnetic Particle Examination
 6. ASTM E1032 Method for Radiographic Examination of Weldments
- D. American Welding Society (AWS):
1. AWS A2.4 Standard Symbols for Welding, Brazing and Nondestructive Examination
 2. AWS A3.0 Standard Welding Terms and Definitions, Including Terms for Brazing, Soldering, Thermal Spraying and Thermal Cutting
 3. AWS A5 Welding Rods, Electrodes, and Filler Metals Series
 4. AWS B1.10 Guide for the Nondestructive Inspection of Welds
 5. AWS C5.4 Recommended Practices for Stud Welding
 6. AWS D1.1 Structural Welding Code Steel
 7. AWS D1.2 Structural Welding Code Aluminum
 8. AWS D1.3 Structural Welding Code - Sheet Steel
 9. AWS D1.4 Structural Welding Code Reinforcing Steel
 10. AWS D1.5 Bridge Welding Code
 11. AWS D9.1 Sheet Metal Welding Code
 12. AWS D10.4 Recommended Practices for Welding Austenitic Chromium- Nickel Stainless Steel Piping and Tubing
 13. AWS D10.9 Specification for Qualification of Welding Procedures and Welders for Piping and Tubing
 14. AWS QC 1 Standard for AWS Certification of Welding Inspectors

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following code:

1. California Code of Regulations, Title 24, Part 2, California Building Code, Chapter 22, "Steel", Section 2209, "Welding", and State Chapter 22A, "Steel", Section 2209A, "Welding".

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures. For Shop Drawings and other submittals, employ the standard welding symbols of AWS A2.4 and the standard welding terms of AWS A3.0.
- B. Welder Qualifications: Submit copies of qualification test records for each welder, welding operator, and tack welder to be employed in the work. Comply with requirements of AWS D1.1. For bridgework, comply with requirements of AWS D1.5. For aluminum welders, comply with AWS D1.2. For pipe and tube, comply with requirements of AWS D10.9.
 1. Submit welders' identification marks (I.D.) for each welder along with qualifications.
- C. Welding Procedure Specifications (WPS): Prior to commencement of welding, submit the procedure specifications that will be used for welding. The WPS shall contain all data indicated in AWS D1.1 Annex IV, and any other information necessary to produce welded joints in compliance with this specification. For procedures other than those prequalified in accordance with AWS D1.1, D1.2, and D1.5, submit a copy of procedure qualification test records in accordance with the qualification requirements of AWS D1.1, AWS D1.2, and AWS D1.5, as applicable.
- D. Welding Records and Data:
 1. Submit all radiographs upon completion of fabrication.
 2. Submit certifications that magnetic particle and dye-penetrant inspections have been satisfactorily completed.
 3. Submit records of ultrasonic testing upon completion.
 4. If field welding is permitted, submit descriptive data for field welding equipment.
- E. Mill Certificates: Submit mill certificates and certified copy of reports for analyses and tests required by referenced ASTM and AWS specifications.

1.07 QUALITY ASSURANCE

- A. Qualifications of Welders and Welding Procedures: Welders, welding operators, tack welders, and welding procedures shall be prequalified or qualified in accordance with the following AWS Welding Codes and Standards:
 1. Structural Steel: AWS D1.1, Section 4, Qualification. Includes steel for miscellaneous metalwork, steel stairs, and railings.

2. Stud Welding: AWS D1.1, Section 7.6, Stud Application Qualification Requirements.
 3. Structural Aluminum: AWS D1.2, Section 5, Qualification of Procedures and Personnel.
 4. Sheet Steel (Structural): AWS D1.3, Section 6, Qualification. Prequalification is not applicable to sheet steel.
 5. Concrete Reinforcing Steel: AWS D1.4, Section 6, Qualification. Coordinate with requirements specified in Section 03 20 00 - Concrete Reinforcing.
 6. Steel for Bridges: AWS D1.5, Section 5, Qualification.
 7. Sheet Metal:
 - a. Welders: AWS D9.1, Section 4, Qualification of Arc Welders and Arc Welding Operators, and Section 9, Qualification of Braze Welders and Braze Welding Operators.
 - b. Welding Procedures: AWS D9.1, Section 3, Arc Welding Procedure Qualification, and Section 8, Braze Welding Procedure Qualification.
 8. Pipe and Tube: AWS D10.9
- B. Qualifications of Welding Inspector: Welds to be inspected by the Contractor shall be inspected and certified by a Contractor-employed AWS Certified Welding Inspector (CWI), certified in accordance with AWS QC 1.
- C. Qualification of Personnel Performing Nondestructive Testing: Personnel performing nondestructive testing, who are Contractor-employed, shall be qualified and certified in accordance with SNT-TC-1A. Only persons certified for NDT Level I and working under a NDT Level II person or persons certified for NDT Level II may perform nondestructive testing.
- D. Weldability of Steel: For structural steel requiring impact test qualification and for corrosion-resistant structural steel, the weldability of the steel and the procedures for welding it shall be established by qualification in accordance with AWS D1.1, Section 4.
- E. Qualification of Stud-Connector Manufacturer: Stud shear connector manufacturer shall be qualified in accordance with AWS D1.1, Annex IX, Manufacturers' Stud Base Qualification Requirements.
- F. Stud Welding Standards: For stud welding, comply with applicable requirements of AWS C5.4 for steel and stainless steel, and AWS D1.2, Section 7, for aluminum.
- G. Moment-Resisting Frames: Welding of beam-to-column joint connections in moment-resisting frames shall conform with the AISC recommendations contained in AISC Northridge Technical Bulletin No. 2.

- H. Iron Contamination of Stainless Steel: Iron contamination of stainless steel will not be accepted. Welds shall be ground smooth and polished at the factory to blend in with the surrounding finish surfaces. Refer also to Section 05 70 00 - Decorative Metal, for requirements.

PART 2 - PRODUCTS

2.01 WELDING ROD/ELECTRODES

- A. Electrodes for structural plate, shapes, pipe, tubes, and bars shall conform with AWS A5 Series Standards and shall be coated rods or wire of size and classification number as recommended by their manufacturers for the positions and other conditions of actual use. Matching filler metal requirements shall conform with AWS D1.1 and AWS D1.5, as applicable.
- B. Electrodes for sheet steel shall conform with AWS A5 Series Standards and shall be coated rods or wire of size and classification number as recommended by their manufacturers for the positions and other conditions of actual use. Matching filler metal requirements shall conform with AWS D1.3.
- C. Welding electrodes and welding rods for stainless steel shall conform with AWS A5.4 and AWS A5.9 as recommended by their manufacturers for the positions and other conditions of actual use. Matching filler metals shall be compatible with the Type 316 or Type 304 stainless steel, as applicable.
- D. Electrodes for aluminum shall conform with AWS A5.10 Series Standards and shall be coated rods or wire of size and classification number as recommended by their manufacturers for the positions and other conditions of actual use. Matching filler metal requirements shall conform with AWS D1.2.

2.02 STUD SHEAR CONNECTORS

- A. Only products of manufacturers qualified in accordance with AWS D1.1, Annex IX, will be accepted for this work.

2.03 SHOP WELDING

- A. Perform shop welding as indicated in accordance with the California Building Code, Section 2209 and State Section 2209A, AWS D1.1, AWS D1.2, AWS D1.3, AWS D1.5, and AWS D9.1, as applicable to the work.
- B. Welders shall mark adjacent to completed welds their welder I.D., using metal stamp, metal engraving, keel, paint stick, or other appropriate marking material.
- C. Welding of stud shear connectors shall conform with AWS D1.1, Section 7, Stud Welding, AWS C5.4, and the stud manufacturer's instructions.
- D. Welding of stainless steel pipe and tube shall conform with applicable requirements of AWS D10.4.

2.04 INSPECTIONS AND TESTS BY THE CONTRACTOR

- A. Visual Inspection: All welds shall be visually examined in accordance with AWS D1.1, Sections 6 and 7.8, as applicable. Quality of welds and standards of acceptance shall be in accordance with AWS D1.1, Section 6.9.
- B. Nondestructive Testing: Nondestructive testing shall conform with AWS B1.10.
- C. Radiographic Testing: Radiographic testing of welds shall conform with AWS D1.1, Section 6.12 and ASTM E94, ASTM E142, and ASTM E1032, as applicable. Complete joint penetration groove welds shall be tested as follows:
 - 1. 10 percent with thickness equal to or less than 3/4 inch.
 - 2. 50 percent with thickness greater than 3/4 inch and equal to or less than 1-1/2 inches.
 - 3. 100 percent for thickness greater than 1-1/2 inches.
- D. Ultrasonic Testing: Ultrasonic testing of welds shall conform with AWS D1.1, Section 6.13, and ASTM E164, as applicable. Complete joint penetration groove welds not accessible for radiographic testing shall, with Engineer's approval, be subjected to ultrasonic testing. The extent shall be the same as specified for radiographic testing.
- E. Magnetic Particle Inspection: Magnetic particle inspection of welds shall conform with ASTM E709. Complete and partial joint penetration groove welds and fillet welds shall be inspected as follows:
 - 1. 20 percent of complete joint penetration groove welds of tee and corner joints.
 - 2. 10 percent of partial joint penetration groove welds and fillet welds.
- F. Liquid Penetrant Inspection: Liquid dye penetrant inspection of welds shall conform with ASTM E165. Liquid penetrant inspection shall be used for detecting discontinuities that are open to the surface.
- G. Test Results: Test result information shall be forwarded to the Engineer immediately after test results are available, stating the acceptance or rejection of fabricated components, so that repairs and reinspection or testing may be performed as soon as possible.
- H. Repairs: Unacceptable welds shall be repaired in accordance with AWS D1.1, Section 5.26. Repaired or corrected welds shall be reinspected or retested as specified for the original weld.

2.05 INSPECTIONS AND TESTS BY THE ENGINEER

- A. All welds are subject to inspections and tests by the Engineer as specified herein. Welds to be inspected and tested by the Engineer will be selected at random.
- B. The Engineer will make test results available to the Contractor.

PART 3 - EXECUTION

3.01 FIELD WELDING: Field welding, where indicated or permitted by the Engineer, shall be performed as herein specified for shop welding.

3.02 INSPECTIONS AND TESTS

- A. The Contractor shall perform inspections and tests of field welds as herein specified for shop welds.
- B. The Engineer reserves the right to perform inspections and tests of field welds as herein specified for shop welds.

3.03 CLEANING:

- A. Welds of stainless steel shall be cleaned in accordance with Section 05 70 00 - Decorative Metal, Article 3.02, Cleaning of Stainless Steel, and shall be protected from damage and corrosion at the factory, during shipping, and at the jobsite until acceptance of the work by the Engineer.

END OF SECTION 05 05 22

BART Facilities Standards (BFS)

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SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Structural Steel for Bridges
- B. Structural Steel for Buildings and Other Structures
- C. Structural Tubing
- D. Pipe
- E. Steel Pins
- F. Anchors and Fasteners
- G. Stud Shear Connectors
- H. Forgings
- I. Castings

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for structural steel will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for structural steel indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for structural steel, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Price: If the Bid Schedule indicates a unit price for structural steel, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Structural steel will be measured for payment by the pound or by the ton, calculated without deduction for holes under 12 inches in longest dimension, for each item, type, and grade of structural steel installed complete in place. Weights will be calculated in accordance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
 - b. Stud shear connectors, shims, wedges, fasteners, shop and field touchup painting, and non-shrink grout for base or bearing plates will not be measured separately for payment. All costs in connection therewith will be considered incidental to and included with the applicable items of structural steelwork.

2. Payment: Structural steel will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.02.C.1.

1.03 REFERENCES

A. American Institute of Steel Construction (AISC):

1. AISC M016 Manual of Steel Construction. Allowable Stress Design
2. AISC S303 Code of Standard Practice for Steel Buildings and Bridges
3. AISC S329 Allowable Stress Design Specification for Structural Joints Using ASTM A325 or A490 Bolts
4. AISC S335 Specifications for Structural Steel Buildings - Allowable Stress Design and Plastic Design, with Commentary
5. AISC S341 Seismic Provisions for Structural Steel Buildings

B. American Railway Engineering and Maintenance of Way Association (AREMA):

1. Manual for Railway Engineering (Fixed Properties), herein referred to as the "AREA Manual", Chapter 15, "Steel Structures"

C. American Society for Testing and Materials (ASTM):

1. ASTM A6/A6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
2. ASTM A27/A27M Specification for Steel Castings, Carbon, for General Application
3. ASTM A36/A36M Specification for Carbon Structural Steel
4. ASTM A47 Specification for Ferritic Malleable Iron Castings
5. ASTM A48 Specification for Gray Iron Castings
6. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
7. ASTM A108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
8. ASTM A148/A148M Specification for Steel Castings, High-Strength, for Structural Purposes
9. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

STRUCTURAL STEEL FRAMING

10. ASTM A194/
A194M Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
11. ASTM A242/
A242M Specification for High-Strength Low-Alloy Structural Steel
12. ASTM A307 Specification For Carbon Steel Bolts, and Studs, 60,000 psi Tensile Strength
13. ASTM A325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
14. ASTM A370 Test Methods and Definitions for Mechanical Testing of Steel Products
15. ASTM A449 Specification for Quenched and Tempered Steel Bolts and Studs
16. ASTM A490 Specification for Heat-Treated Steel Structural Bolts, 150 ksi Tensile Strength
17. ASTM A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
18. ASTM A501 Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
19. ASTM A514/
A514M Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
20. ASTM A563 Specification for Carbon and Alloy Steel Nuts
21. ASTM A572/
A572M Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
22. ASTM A572 Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
23. ASTM A588/
A588M Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
24. ASTM A618 Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
25. ASTM A668/
A668M Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
26. ASTM A673/
A673M Specification for Sampling Procedure for Impact Testing of Structural Steel
27. ASTM A709/ Specification for Carbon and High-Strength Low-Alloy

STRUCTURAL STEEL FRAMING

A709M Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges

- 28. ASTM D4285 Standard Test Method for Indicating Oil or Water in Compressed Air
- 29. ASTM F436 Specification for Hardened Steel Washers
- 30. ASTM F959 Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

D. American Welding Society (AWS):

- 1. AWS A2.4 Standard Symbols for Welding, Brazing and Nondestructive Examination
- 2. AWS D1.1 Structural Welding Code - Steel

E. Steel Structures Painting Council (SSPC):

- 1. SSPC-SP 1 Solvent Cleaning
- 2. SSPC-SP 3 Power Tool Cleaning
- 3. SSPC-SP 6 Commercial Blast Cleaning
- 4. SSPC-SP 10 Near-White Blast Cleaning
- 5. SSPC-SP 11 Power Tool Cleaning to Bare Metal
- 6. SSPC-PA 1 Shop, Field, and Maintenance Painting
- 7. SSPC-Paint 20 Zinc-Rich Primers (Type I – Inorganic and Type II – Organic)
- 8. SSPC-Paint 22 Epoxy-Polyamide Paints (Primers, Intermediate & Topcoat)

1.04 REGULATORY REQUIREMENTS: The regulatory requirements which govern the work of this Section include the following governing code:

California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 22, "Steel", and State Chapter 22A, "Steel".

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings:

1. Submit detailed Shop Drawings of structural steel work prior to fabrication, showing sizes, details of fabrication and construction, methods of assembly, locations of hardware, anchors, and accessories, and erection sequence and details. Include procedures for heavy lifts and rigging. Erection drawings shall be referenced to the Contract Drawings.
2. Shop Drawings shall include member identity, welding technique, cuts, copes, gussets, connections, holes, fasteners, camber, fabrication and erection tolerances, type of finish, paint system, weights of members, and critical clearances.
3. Welds, both shop and field, shall be indicated by standard welding symbols of AWS A2.4. Drawings shall show the size, length, and type of each weld.
 - a. Indicate individual welders' identification (I.D.) on project record drawings.
4. Investigate stresses caused by the proposed erection procedure. Submit drawings showing details of required temporary supports, staying, and bracing. Include descriptive data and design calculations, to illustrate the erection, transportation, and handling procedures, including sequence of erecting and transfer of loads if applicable.
5. Furnish setting diagrams, templates, and directions for the erection of structural framing, anchor bolts, bearing plates, and other embedded items.
6. The Contractor shall be responsible for errors of fabrication and for correct fitting of structural members.

C. Detailing Requirements: Requirements for the detailing of structural steel work are specified herein under Part 2 - Products because of the close relationship of detailing with fabrication requirements.

D. Product Data: Submit manufacturer's product data of load-indicator washers (Compressible-Washer-type direct tension indicators) when proposed for use.

E. Mill Test Reports:

1. Submit certified mill test reports of structural steel materials, covering chemical analysis and physical properties of each heat of steel from which the material for structural steel will be furnished, in conformance with the hereinafter specified ASTM Specifications.
2. Steel materials which are not properly certified as conforming with specified ASTM Specifications will be rejected.

F. Welding Records and Data: Refer to Section 05 05 22 - Metal Welding, for requirements.

1.06 QUALITY ASSURANCE

A. Fabricator's Shop or Facility: Fabricator's shop or facility will be inspected and approved by the Engineer before the start of fabrication work. Notify the Engineer in writing at least ten days

before the scheduled start of fabrication work. Fabrication of structural steel shall be performed by an approved fabricator at an approved facility.

- B. Indicated Dimensions: Unless otherwise indicated, dimensions at expansion joints and similar construction were determined for a temperature of 50 degrees F. Make proper adjustments for temperature when the structure is to be fabricated and installed at any other temperature.
- C. Tolerances:
 - 1. Variation of camber from indicated dimensions:
 - a. Structural rolled beams directly supporting bridge deck: minus zero, plus 1/2 inch for beams 50 feet and shorter, with an additional tolerance of plus 1/8 inch for each 10 feet or fraction thereof in excess of 50 feet.
 - b. Welded plate girders: Conform with requirements of AWS D1.1, Article 5.23, Dimensional Tolerance of Welded Structural Members.
 - 2. Measure camber with beam or girder in a no-load position (laid on its side).
- D. Calibration of Torque Wrenches:
 - 1. The calibrating device for setting calibrated torque wrenches shall be checked for accuracy by the Contractor's qualified personnel not more than 30 days prior to its first use on the work, and at intervals not more than six months thereafter.
 - 2. If the Engineer has reason to question the accuracy of the calibrating device, the Engineer may require that it be returned to the manufacturer for certification of its accuracy.
 - 3. Calibrate torque wrenches as specified in AISC S329.
- E. Qualifications of Welders and Welding Procedures: Refer to Section 05 05 22 - Metal Welding, for requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Avoid bending, scraping, and overstressing the steelwork. Block with wood, or otherwise protect, projecting parts which may be bent or damaged.
- B. Mark weight and piece (mark) number, corresponding to shop erection sequence drawing, on all members. Match-mark all shop pre-fitted members.
- C. Ship small parts, such as bolts, nuts, washers, pins, fillers, clips, and small connecting plates and anchors, in boxes, crates, or barrels. Pack separately each length and diameter of bolt and each size of nut and washer. Plainly mark an itemized list and description of the contents on the outside of each container.
- D. Load, transport, unload, and store structural steel materials in such a manner that the metal is kept clean and free from injury. Store materials above ground on platforms, skids, or other supports, and cover and protect from corrosion.

- E. Handle and store beams and girders in such a manner that they will have the required camber after erection.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Manufactured steel clips and angles will be accepted where such will meet the requirements of the Contract Drawings and are shown on the Shop Drawings.
- B. Structural Steel for Bridges: ASTM A709/A709M, Grade 36, 36T2, 50T2, or 50WT2, as indicated.
1. Identify all materials by heat and lot, if applicable. Correlate with certified mill test reports.
 2. Impact Test Qualification: Specific test requirements for Charpy impact testing for grades 36T2, 50T2, and 50WT2 shall be as follows:
 - a. Sampling and Testing Procedures: ASTM A370 and ASTM A673/A673M, as applicable.
 - b. Frequency of Testing: H.
 - c. Test Temperature: 40 degrees F.
 - d. Condition of Material: As-rolled.
 - e. Orientation of Test Bars: Longitudinal to the direction of final rolling.
 - f. Absorbed Energy Requirements:
 - 1) Normal-strength steel to 4 inches thick and high-strength steel to 2 inches thick for welded construction and to 4 inches thick for bolted construction: 15 ft-lbf.
 - 2) High-strength steel, 2 inches to 4 inches thick, for welded construction: 20 ft-lbf.
 - 3) Subsize Specimens: 12.5 ft-lbf for 10 mm by 7.5 mm specimens, and 10 ft-lbf for 10 mm by 5 mm specimens.
- C. Structural Steel for Buildings and Other Structures:
1. Structural Steel: ASTM A572, Grade 50, or ASTM A36/A36M
 2. High-Strength Steel: ASTM A242/A242M, A572/A572M or A588/A588M, grade or type as indicated.

3. High-Strength Plate for Welding: ASTM A514/A514M.
 4. Impact Tests: For rolled shapes of ASTM A6/A6M Groups 4 and 5, shapes built-up by welding plates 2 inches thick or thicker, and supplied weld filler metals subject to tensile stresses, shall be furnished with Charpy V-notch testing in accordance with ASTM A6/A6M Supplementary Requirements S5. Charpy impact testing shall be in accordance with ASTM A370 and A673/A673M and as specified herein.
- D. Structural Tubing:
1. Cold-Formed Carbon Steel: ASTM A500, Grade B or as indicated.
 2. Hot-Formed Carbon Steel: ASTM A501, minimum yield point of 36,000 psi.
 3. High-Strength, Low-Alloy Steel: ASTM A618, Grade as indicated.
- E. Pipe: ASTM A53, Type E or Type S, Grade B (minimum yield point of 35,000 psi).
- F. Steel Pins:
1. Greater than 9 inches in diameter: ASTM A668/A668M, Class B, C, or D.
 2. 9 inches and less in diameter: ASTM A668/A668M, Class B, C, or D, or ASTM A108, Grades 1016 through 1030.
- G. Anchors and Fasteners:
1. Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform with ASTM A307, Grade A, and ASTM A449, A563, and F436, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153, except bolts, nuts, and washers for structural steel shall be machined items without protective coatings.
 2. High-Strength Bolted Connections: Slip-critical type, high-strength bolts. All other threaded fasteners: Furnished with locking hardware.
 3. High-Strength Carbon Steel Bolts: ASTM A325, Type 1; except provide Type 3 for corrosion-resistant steel.
 4. High-Strength Alloy Steel Bolts: ASTM A490, Type 1; except provide Type 3 for corrosion-resistant steel.
 5. Heavy-Duty Hardened Hex Nuts and Washers:
 - a. Nuts:
 - 1) For Type 1 Bolts: ASTM A194/A194M, Grade 2H, or ASTM A563, Grade DH.
 - 2) For Type 3 Bolts: ASTM A563, Grade C3 or DH3.

- b. Washers: ASTM F436, for use with ASTM A325 or ASTM A490 bolts, as applicable.
- 6. Load-Indicator Washers: ASTM F959, for use with ASTM A325 or ASTM A490 bolts, as applicable.
- 7. Lubricant for Bolts: Molybdenum disulfide base.

H. Stud Shear Connectors:

- 1. Stud connectors shall be produced by cold heading, cold rolling, or cold machining. Finished stud connectors shall be uniform quality and free of injurious laps, fins, seams, cracks, twists, bends, or other defects. Studs shall not have cracks or bursts deeper than one-half the thickness from the periphery of the head to the shaft. Tensile strength of stud connectors shall be determined by tests of bar stock after drawing or of full diameter finished studs. Strength requirements shall conform to the following:

Tensile Strength (min.)	Elongation (min.)	Reduction of Area (min.)
60,000 psi	20 percent in 2 inches	50 percent

- 2. Stud connectors shall be furnished with arc shields (ferrules) of heat-resistant ceramic or other suitable material for welding.

I. Forgings: ASTM A668/A668M, Class C for carbon steel and Class G for alloy steel.

J. Castings:

- 1. High-Strength Steel: ASTM A148/A148M, grade as indicated.
- 2. Mild-to-Medium-Strength Carbon Steel: ASTM A27/A27M, grade as indicated.
- 3. Malleable Iron: ASTM A47, Grade 35018.
- 4. Gray Iron: ASTM A48, Class 30B.

K. Welding Electrodes: Refer to Section 05 05 22 - Metal Welding, for requirements.

L. Open-Web Steel Joists: Refer to Section 05 21 00 - Steel Joist Framing, for requirements.

M. Shop Painting Materials: As herein specified under Article 2.04.

N. Grout: Provide high-strength, non-shrink grout for base plates in accordance with the requirements of Section 03 61 11 - Non-Shrink Grout.

2.02 DETAILING REQUIREMENTS**A. Detailing Standards:**

1. Except as specified otherwise herein or as indicated otherwise on the Contract Drawings, detailing and tolerances shall conform with applicable requirements of AISC S335 and AISC S303.
2. Special seismic detailing provisions shall conform with AISC S341.
3. Items to be galvanized shall be detailed as specified in Section 05 50 00 - Metal Fabrications.

B. Required Provisions:

1. All working points indicated on the Contract Drawings shall be adhered to in the detailing of the work.
2. Substitutions of sections shall be made only as approved by the Engineer.
3. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members.
4. Detail and fabricate work with suitable drain and vent holes as required to provide positive drainage and to prevent the trapping of moisture and stagnant air.

C. Connections:

1. Connections shall be as indicated and as specified herein.
2. Furnish all bolts and bolt placement lists for field and shop connections, including all temporary carbon steel erection bolts and clips required for field erection.
3. Except as otherwise indicated, all connections shall be shop welded and field bolted. Field welded connections will be permitted only where indicated on the Contract Drawings or where specifically approved by the Engineer in writing.
4. Bolted connections shall be made with 3/4-inch or 7/8-inch diameter bolts as specified in ASTM A325, unless otherwise indicated. Tapered washers shall be provided on bolted connections to channels and other structural shapes with sloping flanges.
5. Framed beam connections which are not detailed or otherwise indicated shall be shop welded and field bolted in accordance with AISC M016, Framed Beam Connections, Tables II and III. The Contract Drawings indicate the number of rows of field bolts to be provided; otherwise, the connection shall be detailed using the maximum possible number of rows of 3/4-inch diameter bolts shown in Table II for each beam depth, with minimum connection angles 5/16-inch thick, and using shop weld A or B as shown in Table III to provide the same strength of the bolted end.

6. Detail field splice connections to develop the full strength of the section in which the splice is made.
7. All joints made with high strength bolts shall be considered to be bearing-type connections with threads included in the plane of shear, except moment-resisting joints and connection joints where slip-critical type high-strength bolts are required.

2.03 FABRICATION

- A. Structural steelwork shall conform with the applicable requirements of the California Building Code and AISC S335. Structural steelwork for railroad and transit rail bridges shall conform with applicable requirements of the AREMA Manual.
- B. Welding and welded connections shall conform with the requirements of Section 05 05 22 - Metal Welding.
- C. Steel members and metal fabrications shall be prefabricated and preassembled in the factory or shop as far as practicable.
- D. Form and fabricate the work to meet installation conditions. Include accessories to adequately secure the work in place.
- E. Cutting, drilling, punching, and welding shall be neatly performed with burrs and rough edges removed. Remove all weld flux.
- F. Straighten rolled material, if necessary, before it is laid out for fabrication, in a manner conforming to the mill tolerances specified in ASTM A6/A6M, and by a process and in a manner which will not injure the material. Sharp kinks and bends will be cause for rejection of the material. Heat shrinking of low-alloy structural steel will not be permitted.
- G. Perform shearing, flame cutting, and chipping carefully and accurately so as not to induce residual stress in the metal being cut. The radii of re-entrant gas-cut fillets shall be not less than 3/4 inch and as much larger as practicable. Perform flame cutting in such manner that metal being cut is not carrying stress. Cut edges exposed in the finished work shall be machine cut, sheared, or flame cut, and ground flush. All working points shall be maintained.
- H. Fabricate bearing stiffeners and stiffeners intended as supports for concentrated loads as indicated. Mill or grind bearing surfaces of these stiffeners.
- I. Bend load-carrying cold-rolled steel plates cold at right angles to the direction of rolling. The radius of bend, measured to the concave face of the metal, shall be not less than indicated in the following table, in which T is the thickness of the plate.

Angle Through Which Plate is Bent	Minimum Radius
61 to 120 degrees	1.0 T
121 to 150 degrees	2.0 T

1. If a shorter radius is indicated, bend the plate hot. Before bending, round plate edges, where bending occurs, to a radius of 1/16 inch.
- J. Connections shall be bolted or welded as indicated.
- K. Holes shall be drilled or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Holes in base or bearing plates shall be drilled. Holes shall be provided in members to permit connecting the work of other trades. Holes shall be punched or drilled at 1/16 inch larger than the diameter of the bolt.
- L. For high-strength bolting, assemble joints and install bolts in accordance with AISC S329. Hardened-face washers shall be used for all connections using ASTM A490 bolts. Assembly of joints using load-indicator washers shall conform to ASTM F959. High-strength bolting will be inspected by a qualified inspector employed by the Contractor's testing laboratory.
- M. For items bearing on concrete, provide steel bearing plates and anchors as indicated. Base or bearing plates shall be leveled by means of adjustment nuts. Templates shall be furnished, together with instructions for setting of anchors, anchor bolts, and bearing plates. Contractor shall assure that anchors and related items are properly set in concrete during the progress of the work.
- N. Fabricate metal bearing surfaces which will come in contact with preformed elastomeric bearing pads or grout, flat to within 1/8 inch tolerance in 12 inches and to within 3/16 inch overall.
- O. Include reinforcing angles, clip angles, plates, punched straps, brackets, and hangers as required to complete the work as indicated.
- P. Provide drainage holes in structural components where water may accumulate without escape.
- Q. Fabricate architecturally exposed structural steel members straight within one-half of the standard camber and sweep tolerances permitted by ASTM A6/A6M.

2.04 CLEANING AND PAINTING

- A. Interior, Non-Corrosive Applications:
1. After fabrication and immediately before shop painting, structural steel materials shall be washed with solvent to remove dust and residue in accordance with SSPC-SP 1.
 - a. Structural steel materials not exposed to the public shall be power-tool cleaned in accordance with SSPC-SP 3 to remove mill scale, rust, grease, oil, and any other foreign matter.
 - b. Structural steel materials exposed to public view shall be blast cleaned in accordance with SSPC-SP 10 or power-tool cleaned in accordance with SSPC-SP 11 to remove all visible mill scale, rust, grease, oil, and any other foreign matter.
 2. If materials are not painted immediately after cleaning then those materials shall be washed with solvent to remove dust and residue in accordance with SSPC SP 1.

3. After preparation, steel materials shall be shop painted with one coat of corrosion-inhibitive metal primer in accordance with SSPC PA 1. Materials and application shall conform with SSPC-Paint 20 or SSPC-Paint 22.

B. Exterior Applications:

1. Steelwork to be exposed to weather shall be blast cleaned in accordance with SSPC-SP 10, Near White Blast Cleaning, or power-tool cleaned in accordance with SSPC-SP 11, Power Tool Cleaning to Bare Metal. For new steel bridges, cleaning shall be in accordance with SSPC-SP 10.
2. After cleaning, solvent wash in accordance with SSPC-SP 1, and shop paint steelwork in accordance with SSPC-PA 1. Materials and application shall conform with SSPC-Paint 20, Zinc-Rich Primers, Type I - Inorganic or Type II - Organic. For new steel bridges, only shop-applied Type I – Inorganic Zinc Rich Primers shall be used.
3. Where steel components are indicated to be galvanized, comply with galvanizing requirements of Section 05 50 00 - Metal Fabrications.
 - a. Galvanized components shall be prepared and painted in accordance with the requirements for cleaning and painting in Section 05 50 00 - Metal Fabrication.

C. Steel Materials to Receive Spray-Applied Fireproofing:

1. Steel materials shall be power-tool cleaned in accordance with SSPC-SP 3 to remove mill scale, rust, grease, oil, and any other foreign matter. Welds shall thoroughly wire brushed.
2. After cleaning and just before delivery of steel to the jobsite, steel materials shall be washed with solvent to remove dust and residue in accordance with SSPC-SP 1.
3. Steel materials to receive spray-applied fireproofing shall be shop painted with a primer if recommended by the manufacturer of the fireproofing material, and the primer shall be approved by the manufacturer of the fireproofing material.

D. Steel Materials to Receive Intumescent Fireproofing:

1. Interior steel materials shall be power-tool cleaned in accordance with SSPC-SP 3 to remove mill scale, rust, grease, oil, and any other foreign matter. Welds shall be thoroughly wire brushed.
2. Exterior steel materials shall be blast cleaned in accordance with SSPC-SP 6 to remove visible mill scale, rust, grease, oil, and any other foreign matter. After cleaning and just before delivery of steel to the jobsite, steel materials shall be washed with solvent to remove dust and residue in accordance with SSPC-SP 1.
3. Primer to be shop applied shall be as recommended and approved by the manufacturer of the intumescent fireproofing material, and evidence of such approval shall be submitted to the Engineer for review.

PART 3 - EXECUTION**3.01 ERECTION AND INSTALLATION**

- A. Reference Standards: Erection and installation of structural steel shall conform with the applicable requirements of AISC S303 and AISC S335. Erection and installation of structural steel for railroad and transit rail bridges shall conform with applicable requirements of the AREMA Manual.
- B. Lines and Levels: Structural steel shall be installed accurately at established lines and levels. Steel shall be plumb and level before bolting is commenced. Installation shall be in accordance with accepted Shop Drawings and actual conditions, true and horizontal or perpendicular as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.
- C. Temporary Bracing: Temporary bracing shall be provided as required and shall be kept in position until final completion. Shop fabricated items subject to damage shall be braced and carefully handled to prevent distortions or other damage. All items installed before concrete is placed shall be properly braced to prevent distortion by pressure of concrete. Bracing shall be watched and maintained by the Contractor during concreting operations.
- D. Anchors, Anchor Bolts, Studs, and Fasteners:
1. Shop connections shall be welded and field connections bolted, unless indicated otherwise. Use washers under bolt heads and nuts to give full grip when nuts are turned tight. Use beveled washers where bolts bear on sloping surfaces.
 2. Anchors, bolts and washers, inserts, studs, and fasteners as required for the erection, installation, and completion of the work, and other miscellaneous steel or iron fastenings to be installed in forms before concrete placement, or built into concrete, shall be provided as indicated at the time scheduled for this work.
 3. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.
- E. Bases and Bearing Plates: Bases and plates which require grouting shall be supported at the correct level by means of adjustment nuts on anchor bolts. Bases and plates shall be set accurately using a high-strength, non-shrink grouting mortar as specified in Section 03 61 11 - Non-Shrink Grout.
- F. Erection and Assembly:
1. After erection and field assembly, the various members forming parts of the completed structure shall be aligned and adjusted accurately before being fastened. Tolerances shall conform with the applicable requirements of AISC S303.
 2. Fastening of splices of compression members shall be performed after the abutting surfaces have been brought into contact. Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled. Splices will be permitted only where indicated.

3. Unless removal is required, erection bolts used in welded construction may be tightened securely and left in place. If erection bolts are removed, the holes shall be filled with plug welds and ground smooth. Poor matching of holes shall be corrected by drilling to the next larger size and providing the next larger size bolt. Welding for redrilling will not be permitted.
 4. For moment-resisting joints with flanges or combined flange-reinforcing plates 1-1/2 inches thick or thicker, web bolts shall not be tightened past snug-tight until after completion of joint penetration welds.
- G. Driftpins: Driftpins may be used only to bring together the several parts or components. Fit-up bolts and driftpins shall not be used to bring out-of-tolerance fabricated members and components into alignment. Driftpins shall not be used with such force as to distort or damage the material.
- H. Gas Cutting: The use of a gas-cutting torch in the field for correcting fabrication errors will not be permitted.
- I. Bolting:
1. Bolts shall be driven accurately into holes without damaging the thread. Bolt heads shall be protected from damage during driving. Washers shall be placed under all bolt heads and nuts. Bolt heads and nuts shall rest squarely against the washers.
 2. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing to the head or nut. Bolt threads shall be upset or spoiled to prevent the nuts from backing off.
 3. Bolts transmitting shear shall be threaded to such a length that not more than one thread will be within the grip of the metal.
 4. Bolts shall extend through but not more than 1/4-inch beyond the nuts, unless otherwise indicated. Bolt heads and nuts shall be drawn tight against the work with a suitable wrench not less than 15 inches long. Bolt heads shall be tapped with a hammer while the nut is being tightened. After having been finally tightened, nuts shall be locked by upsetting or spoiling the threads as close as possible to the nut face and to a depth of penetration necessary to deform one or more threads on the bolt.
- J. High-Strength Bolting:
1. Assemble joints in accordance with AISC S329.
 2. Tighten bolts to their proof loads with calibrated impact wrenches to a torque not less than recommended for the size of the bolt.
 3. Assembly of joints using load-indicator washers shall conform to ASTM F959.
 4. Contact surfaces of joints shall be free of paint, lacquer, or other friction-reducing coatings.

- K. Sliding Joints: Properly clean sliding-joint assembly bearing surfaces and lubricate as required.
- 3.02 FIELD QUALITY CONTROL:** Field-assembled and installed high-strength bolting shall be inspected and torque-tested in accordance with AISC S329 by a qualified inspector selected and paid for by the Contractor. Submit the inspector's report of all high-strength bolted connections to the Engineer for review.
- 3.03 FIELD PAINTING**
- A. After installation of structural steelwork, abraded areas, field bolts, and welds shall be touched up and spot painted with the same corrosion-inhibitive primer as was used for shop painting in accordance with SSPC-PA 1. Field welds shall be thoroughly wire-brushed or disc-sanded prior to touch-up painting.
 - B. Steel to receive spray-applied fireproofing shall not be touch-up painted.
 - C. Steel to receive intumescent fireproofing shall be touch-up painted in accordance with the requirements of the intumescent fireproofing manufacturer.
 - D. Final field painting of exposed structural steel is specified in Section 09 91 00 - Painting.

END OF SECTION 05 12 00

SECTION 05 21 00

STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Joist and Joist Girders
- B. Anchors and Bolts
- C. Fasteners and Accessories
- D. Grout

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for steel joists will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for steel joists indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for steel joists, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for steel joists, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Steel joists will be measured for payment per each joist for each type and size, installed complete in place.
 - b. Accessories, bridging, painting, and grouting will not be measured separately for payment; such items will be considered incidental to the steel joist installation.
 - 2. Payment: Steel joists will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.02.C.1.

1.03 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. Specifications for Structural Steel Buildings - Allowable Stress Design and Plastic Design.
 - 2. Code of Standard Practice for Steel Buildings and Bridges.
- B. American Society for Testing and Materials (ASTM):

1. ASTM A36 Specification for Structural Steel
2. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3. ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
4. ASTM A449 Specification for Quenched and Tempered Steel Bolts and Studs
5. ASTM A563 Specification for Carbon and Alloy Steel Nuts
6. ASTM F436 Specification for Hardened Steel Washers

C. Steel Joist Institute (SJI):

1. Standard Specifications, Load Tables & Weight Tables for Steel Joists & Joist Girders
2. Standard Specifications for Open Web Steel Joists, K-Series
3. Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series
4. Standard Specifications for Joist Girders
5. Technical Digest #8, "Welding of Open Web Steel Joists"

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit detailed Shop Drawings of steel joists and joist-girders and related miscellaneous metalwork, showing sizes, details of fabrication and construction, locations of hardware, anchors, and accessories, and erection and installation details.
- C. Certification: Submit evidence of SJI membership, or evidence that designs of indicated joists and girders have been checked and accepted by SJI.
- D. Inspection Reports: Submit inspection results of required inspections in accordance with the requirements of Article 2.03 herein.

1.05 QUALITY ASSURANCE

- A. Fabricators' Qualifications: Fabricator shall be a member of the Steel Joist Institute, or shall be a manufacturer who regularly produces steel joists of the K-, LH-, or DLH-Series, or joist girders conforming to SJI's Specifications and Load Tables and whose designs have been checked and accepted by the Institute.

- B. Qualifications of Welders and Welding Procedures: Refer to Section 05 05 22 - Metal Welding, for requirements. Comply also with requirements of SJI's Technical Digest #8, "Welding of Open Web Steel Joists."

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

- A. Joists and Joist Girders: Materials and fabrication (or design and manufacture) of joists shall conform with the referenced SJI Standard Specifications for the type or types of joists and joist girders indicated. Provide horizontal bridging for top and bottom chords as indicated.

- 1. Joists and girders shall be of the following types as indicated:

- a. Open web steel joists (K-Series);
- b. Longspan steel joists (LH-Series);
- c. Deep longspan steel joists (DLH-Series); and
- d. Joist Girders (G).

- B. Accessories:

- 1. Anchors and Bolts: Bolts and studs, nuts, and washers shall conform with ASTM A307, A449, A563, and F436, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.
- 2. Fasteners and Accessories: Provide anchors and fasteners, washers, straps, and accessories required for a complete and finished installation. Fasteners shall be stainless steel, galvanized steel, or cadmium plated, or other approved non-corrodible metal. Baseplates or bearing plates shall be steel plate conforming to ASTM A36.

- C. Grout: High-Strength, non-shrink grout conforming to requirements of Section 03 61 11 - Non-Shrink Grout.

2.02 SHOP PAINTING

- A. Steel joists and joist girders shall be properly cleaned and painted in accordance with the referenced SJI Standard Specifications. Conform also with applicable provisions of Section 05 12 00 - Structural Steel Framing, for painting of steel for the location.

2.03 INSPECTIONS AND TESTS

- A. The Contractor shall require joist manufacturer's inspection as required by the SJI Standard Specifications. Inspection results shall be submitted to the Engineer as specified in Article 1.04 herein.
- B. Materials, fabrication, and welds may be inspected by the Engineer in the manufacturer's factory. Inspection method will be visual. The Engineer reserves the right to perform additional inspections and tests on work that is questionable or suspect. Tests will be non-destructive type.

- C. The Contractor will bear the cost for the Engineer's inspection and tests, if such inspections and tests reveal failure of portions of the work to comply with requirements indicated in these Specifications. The Contractor shall bear all costs made necessary by such failures including those of repeated testing and inspections.

PART 3 - EXECUTION

3.01 ERECTION

- A. Erect steel joists and joist girders as indicated and in accordance with the reviewed and accepted submittals and the SJI Standard Specifications for the type of joists and joist girders indicated. Conform also with applicable requirements of AISC "Specifications for Structural Steel Buildings - Allowable Stress Design and Plastic Design."
- B. Align and adjust joists accurately before fastening. Tolerances shall conform with AISC "Code of Standard Practice for Steel Buildings and Bridges." Fastening of splices of compression members shall be performed after the abutting surfaces have been brought into contact. Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before the members are assembled. Splices will be permitted only where indicated.
- C. Set joists accurately at the established lines and levels. Joists shall be plumb and level (with indicated allowance for camber) before bolting is commenced. Temporary bracing shall be provided as required and shall be kept in position until completion of erection, anchorage, and bridging.
- D. Install support bases, bearing plates, and the ends of top chords, that require grouting, exactly at the proper level by means of steel wedges and by means of adjustment nuts on anchor bolts.
- E. Grouting shall conform with the requirements specified in Section 03 61 11 - Non-Shrink Grout.
- F. Install horizontal bridging for top and bottom chords as indicated and in accordance with the SJI Standard Specifications.

3.02 FIELD PAINTING

- A. After erection, spot paint and touch up all field bolts, field welds, and abrasions to the shop coat. Clean surfaces properly as required for paint adherence and as required to prevent corrosion. Use same paint as was used for shop painting.

END OF SECTION 05 21 00

SECTION 05 30 00

METAL DECKING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Floor and Roof Decking
- B. Accessories
- C. Galvanizing Repair Materials

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for metal decking will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for metal decking indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for metal decking, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Price: If the Bid Schedule indicates a unit price for metal decking, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Metal decking will be measured for payment by the square foot or square yard of each type, installed complete in place.
 - b. Stud shear connectors, accessories and galvanizing repair will not be measured separately for payment; such items will be considered incidental to the metal decking.
 - 2. Payment: Metal decking will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.02.C.1.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A446/A446M Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
 - 2. ASTM A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM A780 Practice for Repair of Damaged and Uncoated Areas of Hot-

Dip Galvanized Coatings

B. Steel Deck Institute (SDI):

1. SDI Publication No. 27 Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Metal Floor Deck with Electrical Distribution

1.04 REGULATORY REQUIREMENTS: The regulatory requirements which govern the work of this Section include the following governing code:

California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 22, "Steel", and State Chapter 22A, "Steel".

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit detailed Shop Drawings of metal decking, showing grade, size, section profile, and thickness of decking, lapping of decking, locations of welds, and method of attachment.
- C. Product Data: Submit manufacturer's product data and design data of the floor and roof decking, along with applicable accessories.
 1. Submit product data on galvanizing repair materials.
- D. Certification: Submit evidence that the shear capacity of manufacturer's decking has been accepted by the International Conference of Building Officials and that a valid Research Recommendation is on file.

1.06 QUALITY ASSURANCE

- A. Qualifications of Welders and Welding Procedures: Refer to Section 05 05 22 - Metal Welding, for requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Decking: Floor and roof decking shall be formed of steel sheet conforming to ASTM A446/A446M, Grade as indicated, Coating Designation G90 (1.25 ounce commercial zinc coating) conforming to ASTM A653/A653M. When grade is not indicated, provide minimum Grade B decking. Type of decking units, weight of metal (metal gage), and section profile shall be as indicated.
 1. Provide floor and roof decking with prepunched tabs for ceiling suspension hanger wires where indicated or required for suspended ceilings.

- B. Accessories: Provide cell end closures, column flashings, recessed sump pans, and any other closures and flashings as indicated or required for complete and finished installations and as required to prevent leakage of concrete. Provide cover caps for covering abutting ends where required. Accessories and flashings shall be of the same material as the decking and shall be not lighter than 22 gage. Accessories shall be the decking manufacturer's standard types, galvanized, and shall be provided as follows:
1. Adjusting plates or segments of deck units in locations too narrow to accommodate full-size units.
 2. End closures to close the open ends at openings through the roof, where units terminate at exterior walls, and other locations where required. Closures shall be not lighter than 22 gage.
 3. Closures for closing voids above interior walls and partitions that are perpendicular to the direction of the flutes or corrugations. Closures above typical partitions shall be compressible closed cell neoprene or vinyl synthetic rubber. Closures above fire-resistant interior walls and partitions shall be minimum 20 gage sheet steel galvanized, and shall be provided at both sides of the wall or partition.
 4. Provide sump pans at drains as indicated, fabricated from metal not lighter than 14 gage.
- C. Welding Electrodes: Refer to Section 05 05 22 - Metal Welding, for requirements.
- D. Stud Shear Connectors: Refer to Section 05 12 00 - Structural Steel Framing, for requirements.
- E. Galvanizing Repair Materials: Conform with requirements of ASTM A780. Commercial cold galvanizing compounds manufactured for the purpose will be accepted provided they meet or exceed requirements of ASTM A780.

2.02 FABRICATION

- A. Metal decking and associated metal fabrications shall conform with applicable requirements of the California Building Code, Chapters 22 and 22A, and SDI Publication No. 27.
- B. Fabricate floor and roof decking for composite construction with shear studs or lugs to provide mechanical key for transferring horizontal shear and for preventing vertical separation. Provide decking with shear studs and hold-down lugs to achieve composite action between decking and concrete fill.
- C. Welding and welded connections shall conform with the requirements of Section 05 05 22 - Metal Welding.
- D. Steel decking and associated fabrications shall be prefabricated and preassembled in the factory or shop as far as practicable.
- E. Galvanized metalwork necessitating welding which in any manner removes or damages original galvanizing shall be restored by galvanizing repair in accordance with ASTM A780.

2.03 INSPECTIONS AND TESTS

- A. Materials, fabrications, and welding are subject to inspections in the shop conducted by the Engineer. Tests shall be performed by the Contractor, at Contractor's expense, using an approved independent testing laboratory.
- B. Welds shall be inspected by the Contractor as specified in Section 05 05 22 - Metal Welding.

PART 3 - EXECUTION**3.01 ERECTION AND INSTALLATION**

- A. Install decking as indicated and in accordance with the approved submittals and the decking manufacturer's installation instructions. Provide decking complete, including shaping, cutting, fitting, drilling, welding, flashings, closure strips, closure plates, fasteners, and accessories necessary for a complete and finished installation.
- B. Install decking in straight and continuous rows as far as practicable, with ribs at right angles to structural supporting members. End laps shall occur over bearings only, and where sheets are lapped, end laps shall be not less than 2 inches. Where ends of decking sheets abut without overlapping at supports, each end of decking shall have a minimum bearing of 1 inch on supports.
- C. Stud shear connectors to be installed on metal decking shall be installed directly over webs of beams for single row installations.
- D. Type of welding, number of welds, size of welds, and locations of welds shall be in accordance with the approved Shop Drawings and the decking manufacturer's installation instructions. Welding shall conform with the requirements of Section 05 05 22 - Metal Welding.
- E. Welds shall be cleaned immediately by wire-brushing, and shall be coated with galvanizing repair material before being covered by the succeeding sheet.
- F. Decking shall be weighted at the point of welding with sand bags or other approved method to hold them in firm contact with each other and structural supports.
- G. Secure solid welds where sheets are warped or bent to certain radii and where decking is placed on a slope while supporting members are framed in a straight position.
- H. Button punches or crimping devices may not be substituted for welding.
- I. Holes and openings for services and other projections through decking shall be cut and fitted neatly and accurately and shall be reinforced as necessary for rigidity and load-carrying capacity.

3.02 GALVANIZING REPAIR

- A. Galvanized surfaces which have become damaged from welding, handling, or installation shall be repaired immediately after installation with galvanizing repair material in accordance with ASTM A780. Galvanizing repair shall be performed and completed before concrete is placed.

3.03 FIELD QUALITY CONTROL

- A. Field welds and shear studs shall be inspected and approved by the Engineer in writing as specified in Section 05 05 22 - Metal Welding.

3.04 CONCRETE FILL

- A. Concrete fill, where indicated, shall conform with applicable requirements of Section 03 30 00 - Cast-in-Place Concrete, and Section 03 05 15 - Portland Cement Concrete.

END OF SECTION 05 30 00

BART Facilities Standards (BFS)

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SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Steel Framing Members
- B. Screws
- C. Bolts
- D. Power-driven Fasteners
- E. Expansion Bolts

1.02 RELATED SECTIONS

- A. Metal framing of 20, 22, and 25 gage metal studs and joists and metal ceiling suspension systems are specified in Section 09 22 00 - Supports for Plaster and Gypsum Board.

1.03 MEASUREMENT AND PAYMENT

- A. General: Cold-formed metal framing will not be measured separately for payment but will be paid for as part of the indicated Contract lump sum price for Architectural work.

1.04 REFERENCES

- A. American Iron and Steel Institute (AISI):
 - 1. AISI SG-673 Specification for the Design of Cold-Formed Steel Structural Members
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A570/A570M Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
 - 2. ASTM A611 Specification for Steel, Sheet, Carbon, Cold-Rolled, Structural Quality
- C. Steel Structures Painting Council (SSPC):
 - 1. SSPC-PA 1 Shop, Field, and Maintenance Painting

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittals, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit detailed Shop Drawings of steel studs and joists, showing

grade, size, and thickness of framing members, layout of framing, installation details, and methods of anchorage and attachment. Indicate strapping, bracing, splices, bridging, and accessories as required for proper installation.

- C. Product Data: Submit manufacturer's product data of the framing members, along with applicable accessories.

1.06 DELIVERY AND STORAGE

- A. Protect metal framing members from corrosion and damage. Deliver to site in manufacturer's unopened containers or bundles, fully identified by type, size, and grade. Store off the ground in a dry ventilated space.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel: Steel for light gage structural framing, studs, tracks, joists, bridging, sills and headers, shall conform with ASTM A570/A570M, minimum Grade 33, or ASTM A611, minimum Grade C, with a minimum yield point of 33,000 psi. Light gage structural framing shall conform with applicable requirements of AISI SG-673. Framing members and accessories shall be delivered to the job with manufacturer's standard oven-dried coat of corrosion-inhibitive metal primer.
- B. Framing Members:
1. Studs: "C" studs or standard channel studs of sizes indicated. Studs shall be 16 gage steel. Short lengths may be 18 gage steel. Studs shall be unpunched where required to be bolted.
 2. Tracks: Unpunched channels, of same size, type, and, gage (metal thickness) as studs, for floor and ceiling tracks.
 3. Joists: Punched channel joists of sizes indicated. Joists shall be 16 gage steel as indicated. Short lengths may be 18 gage steel. Joists shall be unpunched where required to be bolted. Provide joists for floors, ceilings, and soffits as indicated.
 4. Heavier Members: Where studs or joists are required to be heavier steel because of long lengths or heavy loads, provide 12 or 14 gage components as indicated or required.
- C. Screws: Self-drilling, self-tapping hardened steel screws manufactured specifically for the purpose and capable of penetrating 12 gage or heavier sheet steel of structural quality. Provide screws with corrosion-inhibitive coating.
- D. Bolts: 1/4-inch diameter galvanized steel bolts with matching nuts. Provide galvanized washers for all bolt heads and nuts.
- E. Powder-Driven Fasteners: 1/4-inch diameter fasteners with washers, may be used for attaching tracks in lieu of anchor bolts if first approved by the Engineer for the location. Use washers with all inserts. Powder-driven fasteners will not be permitted for use on concrete curbs or along the edge of concrete or a concrete joint.

- F. Expansion Bolts: Galvanized expansion type anchors with matching galvanized steel bolts or studs, minimum 1/4-inch diameter, may be used for attaching tracks in lieu of anchor bolts if first approved by the Engineer for the location. Use washers under all bolt heads and nuts. Expansion bolts shall be located at least 4 inches from the edges or corners of concrete.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install steel studs and joists as indicated and in accordance with the approved submittals and the manufacturer's installation instructions by skilled installers experienced in the type of work involved.
- B. Provide bridging for studs and joists in accordance with the framing manufacturer's instructions.
- C. Install backing plates and reinforcing of the various types indicated or required for the mounting of all items on or in partitions, framed walls, or shafts. Exact position of backing work shall be as designated by the trade whose work will be fastened thereto. The end result shall be that all items attached to or framed in gypsum wallboard surfaces shall be firmly and solidly mounted.
1. Backing plates for grab bars, handrails, and cabinets shall be a minimum of 16 gage galvanized steel, 4 inches in height, and shall span at least two studs. Backing plates for toilet accessories and other items requiring backing shall be a minimum of 20 gage galvanized steel, 4 inches in height, and shall span at least one stud past point of connection.
- D. Provide miscellaneous steel sections and accessories as indicated or required to complete the work.
- E. Erection technique shall result in plumb and straight walls and level ceilings and soffits with no waves or buckles or unevenness at joints. Finished walls shall be a flat plane to within plus or minus 1/8 inch in 8 feet when checked in any direction with an 8-foot straightedge and plumb to within plus or minus 1/8 inch, top to bottom. Finished ceilings shall be level and flat to within plus or minus 1/8 inch in 8 feet when checked with a carpenter's level or surveyor's level.

3.02 FIELD PAINTING

- A. After erection and installation, spot paint and touch up all field bolts, field welds, and abrasions to the shop coat in accordance with SSPC-PA 1, Shop, Field & Maintenance Painting. Clean surfaces for paint adherence and as required to prevent corrosion. Provide same paint as was used for shop painting.

END OF SECTION 05 40 00

BART Facilities Standards (BFS)

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Gratings
- B. Metal Walkways
- C. Trench Drains
- D. Ladders
- E. Concrete Stair Nosing
- F. Steel Clips, Angles, Tubes, Pipes and Shapes
- G. Anchors and Bolts
- H. Galvanizing of Steel and Ferrous Metal Items

1.02 RELATED SECTIONS

- A. Refer to the work under Division 32, Exterior Improvements and Division 33, Utilities, for curb and gutter inlets, catch-basin gratings, manhole covers, and other metalwork associated with, or embedded in, concrete utility structures.
- B. Stair nosing for precast concrete steps are specified in Section 03 40 00 - Precast Concrete.

1.03 MEASUREMENT AND PAYMENT

- A. General
 - 1. Measurement and payment for metal fabrications and miscellaneous metal items will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for metal fabrications and miscellaneous metal items indicated in the Bid Schedule of the Bid Form.
 - 2. When metal fabrications or miscellaneous metal items are included as architectural features or components of the structure, they will not be measured separately for payment, but will be included in the lump-sum measurement for Architectural Work.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for metal fabrications and miscellaneous metal items, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.

C. Unit Price: If the Bid Schedule indicates a unit price for metal fabrications and miscellaneous metal items, the unit-price method of measurement and payment will be as follows:

1. Measurement: Metal fabrications and miscellaneous metal items will be measured for payment by the lump sum, by the pound, by the linear or square foot, or per each metal fabrication or miscellaneous metal item, acceptably fabricated and installed, as indicated in the Bid Schedule of the Bid Form. When measured by the pound, weights will be calculated in accordance with AISC Code of Standard Practice for Steel Buildings and Bridges as specified in Section 05 12 00 - Structural Steel Framing.
2. Payment:
 - a. Metal fabrications and miscellaneous metal items will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement methods specified in Article 1.03.C.1.
 - b. Metal fabrications and miscellaneous metal items for architectural features or components of the structure will be paid for as part of the indicated Contract lump-sum price for Architectural Work.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A27 Specification for Steel Castings, Carbon, for General Application
2. ASTM A36 Specification for Carbon Structural Steel
3. ASTM A47 Specification for Ferritic Malleable Iron Castings
4. ASTM A48 Specification for Gray Iron Castings
5. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
6. ASTM A108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
7. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
8. ASTM A143 Recommended Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
9. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
10. ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
11. ASTM A384 Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
12. ASTM A385 Practice for Providing High-Quality Zinc Coatings (Hot-Dip)

13. ASTM A449 Specification for Quenched and Tempered Steel Bolts and Studs
14. ASTM A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
15. ASTM A501 Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
16. ASTM A536 Specifications for Ductile Iron Castings
17. ASTM A563 Specification for Carbon and Alloy Steel Nuts
18. ASTM A668 Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
19. ASTM A780 Practice for Repair of Damaged Hot-Dip Galvanized Coatings
20. ASTM D2092 Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint
21. ASTM F436 Specification for Hardened Steel Washers

B. National Association of Architectural Metal Manufacturers (NAAMM):

1. Metal Bar Grating Manual

C. Steel Structures Painting Council (SSPC):

1. SSPC-SP 1 Solvent Cleaning
2. SSPC-SP 3 Power Tool Cleaning
3. SSPC-PA 1 Shop, Field & Maintenance Painting
4. SSPC-Paint 20 Zinc-Rich Primers (Type I – Inorganic & Type II – Organic)
5. SSPC-Paint 22 Epoxy-Polyamide Paints (Primers, Intermediate & Topcoats)

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit fully detailed Shop Drawings of metal fabrications and miscellaneous metalwork, showing sizes, details of fabrication and construction, methods of assembly, locations of hardware, anchors, and accessories, and installation details.
 1. Detailing Requirements: Detail steel components as specified in Section 05 12 00 - Structural Steel Framing, and items to be galvanized in accordance with applicable requirements of ASTM A384 and ASTM A385. Detail and fabricate work with suitable drain and vent holes to provide positive drainage and to prevent trapping of moisture and stagnant air.

- C. Product Data: Submit manufacturers' product data of all manufactured items and products.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Manufactured steel clips and angles will be accepted where such will meet the requirements of the Contract Drawings and are shown on approved Shop Drawings.
- B. Steel Materials:
1. Shapes: Standard structural sections, shapes, plates, and bars, as indicated, conforming with ASTM A36. Bars conforming with ASTM A108 will be accepted.
 2. Tubing: Steel tubing, conforming with ASTM A500 or ASTM A501, of size and shape indicated.
 3. Pipe: Steel pipe or round tubing, conforming to ASTM A53, Type E or S, Grade A, of diameters and sizes indicated. Pipe for sleeves and exterior locations shall be galvanized pipe as specified in ASTM A53.
- C. Welding Rods/Electrodes: Refer to Section 05 05 22 - Metal Welding, for requirements.
- D. Castings: ASTM A27, A47, A48, or A536, as applicable to the work.
- E. Forgings: ASTM A668, of Class indicated or required.
- F. Anchors and Bolts: ASTM A307, A449, A563, and F436, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.
- G. Fasteners and Accessories: Furnish anchors and fasteners, washers, straps, and accessories as required for a complete and finished installation. Fasteners shall be stainless steel or galvanized steel as appropriate and approved for the location.
- H. Concrete and Masonry Anchors: Where anchors are not cast into the concrete or masonry construction, provide galvanized expansion type anchors with matching galvanized steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts.
- I. Gratings:
1. Bar-Type Gratings:
 - a. Provide flat-bar type steel gratings of all-welded construction, consisting of bearing bars and secondary bars in rectangular configuration, with flat/plane level traffic surface, hot-dip galvanized after fabrication. Provide gratings with matching hot-dip galvanized steel frames for anchoring in concrete. Comply with applicable requirements of NAAMM "Metal Bar Grating Manual."
 - b. Notch or frame openings in gratings for penetrations as indicated. Lay out units to allow grating removal without disturbing items penetrating the grating. Provide banding for openings in grating separated by more than four bearing bars, of same material and size as bearing bars.

- c. Cut, drill, and fit gratings as required for installation. Notching of bearing bars to provide supports for maintaining elevations will not be permitted.
2. Perforated Sheet Gratings:
 - a. Provide perforated sheet gratings fabricated from button-embossed structural steel sheet of minimum 12 gage thickness, with punched circular holes at apex of buttons for nonslip effect, and punched circular holes between buttons for drainage. Buttons shall be spaced 5/8 inch on centers. Drainage holes shall be spaced 1-1/4 inches on centers, eliminating the buttons at these locations. Hole size for button holes shall be 1/8-inch diameter, plus or minus 1/32 inch. Hole size for drainage holes shall be 1/4-inch diameter, plus or minus 1/16 inch.
 - b. Supporting edges shall be channel- or U-shaped, formed edges capable of supporting a uniform live load of 300 pounds per square foot and a concentrated load of 3,000 pounds. Provide additional reinforcing as necessary to support the specified loads.
 - c. Provide gratings with matching steel frames for anchoring in concrete. Provide frames with appropriate concrete anchors.
 - d. Gratings and frames shall be hot-dip galvanized after fabrication in accordance with ASTM A123.

J. Metal Walkways:

1. Provide metal walkways where indicated, fabricated from checkered or diamond-pattern steel plate or from button-embossed structural steel sheet as specified above for perforated sheet gratings.
2. Walkway panels shall be of sizes and plate or sheet thickness indicated, cut or formed to shape and configuration indicated. Walkway panels shall be removable where they serve as covers for wireways and trenches. Provide removable panels/covers with matching steel frames for anchoring in concrete. Provide hinges, chains, and related opening hardware as indicated for wireway covers. All hardware items shall be 300 series stainless steel or galvanized after fabrication.
3. Walkway panels shall be capable of supporting a uniform live load of 150 pounds per square foot and a concentrated load of 1,500 pounds.
4. Walkway panels and frames, including supporting and reinforcing components and accessories, shall be hot-dip galvanized after fabrication in accordance with ASTM A123.
5. When checkered or diamond-pattern steel plate is provided for walkway panels, coat panels with nonslip encapsulated aluminum oxide material bonded or fused to the steel surface. Submit product data and sample for approval.

K. Trench Drains:

1. Provide standard manufactured trench frames with grated or solid covers, as indicated, of sizes and configurations indicated. Trench drains/frames and covers shall be

manufactured of gray iron conforming to ASTM A48 or ductile iron conforming to ASTM A536 or a combination of both. Provide heavy-duty type.

2. Provide covers with machined bearing surfaces to prevent rocking and rattling.
3. Where pedestrian traffic will travel over trench drains, provide covers with nonslip surface.
4. That portion of trench drains/frames to be in contact with concrete, earth or fill, shall be coated with bituminous emulsion.

L. Ladders:

1. Provide standard-manufactured or custom-fabricated steel ladders as required to meet the conditions indicated. Steel ladders shall be hot-dip galvanized after fabrication. Ladders may be anodized aluminum where not required to serve as a fire exit.
2. Ship's ladders shall be provided with railings and handrails. Vertical ladders exceeding 10 feet in height shall be provided with safety cages.

M. Concrete Stair Nosings: Abrasive white bronze with "hot patina" finish. Provide stair nosings of sizes and profiles indicated with nonslip finish and clean and well-defined cross-hatching and fluting a minimum of 1/16-inch deep. Provide stair nosings with appropriate integral concrete anchors; holes and countersinks for screw-type anchors are not acceptable. Minimum width of tread surface: 3 inches. Minimum thickness of tread or horizontal portion of nosing: 5/16 inch. Stair nosings for cast-in-place concrete stairs shall have full radius return. Stair nosings for concrete-filled metal pan stairs shall have surface radius. Stair nosings at each tread shall be of a single piece; with no joints.

1. "Hot patina" finish shall be produced with the following chemicals to achieve a statuary bronze color acceptable to the Engineer:
 - a. Liver of sulfur
 - b. Ammonium sulfide
 - c. Ferric nitrate
2. Stair nosings for precast concrete steps are specified in Section 03 40 00 - Precast Concrete.

N. Grout: Provide high-strength, non-shrink grout for base plates and bearing plates in accordance with the requirements of Section 03 61 11 - Non-Shrink Grout, and Section 05 12 00 - Structural Steel Framing, as applicable.

O. Paint: Corrosion-inhibitive protective metal primer as herein specified under "Cleaning and Painting".

2.02 FABRICATION

A. Metalwork shall be fabricated by firms or shops experienced and skilled in the custom fabrication and construction of metal fabrications and miscellaneous metalwork. There shall be no exposed screws, bolts, and fasteners in the finished work, except as indicated or required.

- B. Welded connections shall be made in accordance with requirements of Section 05 05 22 - Metal Welding. Welds where exposed to view shall be ground and dressed smooth, so that the shape and profile of the item welded is maintained.
- C. Metal fabrications shall be prefabricated and preassembled in the factory or shop as far as practicable.
- D. Form and fabricate the work to meet installation conditions. Include anchors, fasteners, and accessories to secure the work in place, as indicated.
- E. The Contractor may furnish standard manufactured products for components when applicable, providing such products meet space limitations and installation conditions and are approved by the Engineer.

2.03 GALVANIZING

- A. Steel and ferrous metal items on the exterior of buildings, items exposed to the weather and moisture, gratings, and items specifically indicated, shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform to the requirements specified under "Weight of Coating" in ASTM A123. Provide high-quality galvanizing in conformance with ASTM A385.
 - 1. Seal-weld Overlapping Surfaces: Remove all weld flux. Plug vents provided in seal-welded overlapping surfaces to prevent entry of pickling acids. Remove such plugs before galvanizing.
- B. Safeguarding against steel embrittlement shall conform to the applicable requirements of ASTM A143.
- C. Safeguarding against warpage and distortion of steel members shall conform to the applicable requirements of ASTM A384.
- D. Shop galvanized metalwork necessitating field welding which in any manner removes original galvanizing shall be restored by field galvanizing repair in accordance with ASTM A780.
- E. Bolts and screws for attachment of galvanized items shall be galvanized in accordance with ASTM A153.

2.04 CLEANING AND PAINTING

- A. Nongalvanized Metalwork:
 - 1. After fabrication and immediately before shop painting, ferrous metalwork shall be power-tool cleaned in accordance with SSPC-SP 3 to remove mill scale, rust, grease, oil, and any other foreign matter. Welds shall be thoroughly wire brushed.
 - 2. After power-tool cleaning and just before shop painting, ferrous metalwork shall be washed with solvent to remove dust and residue in accordance with SSPC-SP 1.
 - 3. After cleaning and solvent washing, ferrous metalwork shall be shop painted with one coat of corrosion-inhibitive metal primer in accordance with SSPC-PA 1. Materials and application shall conform to SSPC-Paint 20 or SSPC-Paint 22.

B. Galvanized Metalwork:

1. Galvanized metal surfaces indicated to be painted shall be prepared for painting in accordance with ASTM D2092.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install metal fabrications and miscellaneous metalwork as indicated and in accordance with the approved Shop Drawings, using workers skilled and experienced in the installation of the type of work involved.
- B. Install metal fabrications and miscellaneous metalwork with all installation accessories furnished by the fabricator as required for complete and finished installations.
- C. Installation of metalwork shall be in accordance with approved Shop Drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.
- D. Field welding, where indicated, shall conform to requirements of Section 05 05 22 - Metal Welding.
- E. Where bases and bearing plates require grouting, conform to requirements of Section 03 61 11 - Non-Shrink Grout, and Section 05 12 00, Structural Steel Framing, as applicable.

3.02 GALVANIZING REPAIR

- A. Galvanized surfaces which have become damaged from welding, handling, or installation shall be repaired immediately after installation with galvanizing repair material in accordance with ASTM A780.

3.03 FIELD PAINTING

- A. After installation, exposed painted surfaces, field welds, and other abraded or damaged primed surfaces shall be prepared as required and touched up with an additional coat of the same primers for ferrous and galvanized surfaces as herein- before specified for shop painting. Spray-paint all touch-up work.
- B. Finish field painting, where required, is specified in Section 09 91 00 - Painting.

END OF SECTION 05 50 00

SECTION 05 51 00

METAL STAIRS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Concrete Pan-filled Stairs
- B. Industrial Type Stairs
- C. Safety Tread Stairs
- D. Railing System

1.02 RELATED SECTIONS

- A. Railings not directly related to metal stairs are specified in Section 05 52 00 - Metal Railings.
- B. Stainless steel handrails and railings are specified in Section 05 70 00 - Decorative Metal.
- C. For stair nosings, see Section 05 50 00 - Metal Fabrications.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement
 - 1. Metal stairs and related railings and handrails will be measured for payment by the lump-sum method, acceptably fabricated and installed. Top, bottom, and intermediate landings, and supporting steel will be included in the lump-sum measurement.
 - 2. Accessories, shop painting and field touchup, concrete, anchorage and grouting will not be measured separately for payment; such items will be considered incidental to the metal stairs installation.
- B. Payment: Metal stairs and related railings and handrails will be paid for at the Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials
 - 2. ACI 301 Standard Specifications for Structural Concrete
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36/A36M Specification for Carbon Structural Steel

METAL STAIRS

2. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
4. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
5. ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
6. ASTM A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
7. ASTM A501 Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
8. ASTM A570/A570M Specification for Steel, Sheet and Strip, Carbon, Hot-Quality Rolled, Structural
9. ASTM A611 Specification for Steel, Sheet, Carbon, Cold-Rolled, Structural Quality
10. ASTM C33 Specification for Concrete Aggregates

C. Steel Structures Painting Council (SSPC):

1. SSPC-SP 1 Solvent Cleaning
2. SSPC-SP 3 Power Tool Cleaning
3. SSPC-SP 10 Near-White Blast Cleaning
4. SSPC-SP 11 Power Tool Cleaning to Bare Metal

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Stair Design: Stairs shall be designed and engineered by the manufacturer, incorporating specified criteria, and employing a professional civil or structural engineer currently registered in the State of California to perform the design engineering. Include design data along with Shop Drawings. Drawings and design data shall be stamped and signed by the manufacturer's professional engineer.
- C. Shop Drawings: Submit fully detailed Shop Drawings of metal stairs and railings, showing sizes, details of fabrication and construction, methods of assembly, handrail brackets, locations of hardware, anchors, and accessories, and installation details.

- D. Product Data: Submit manufacturer's product data of stair type and corrosion-inhibitive finish system. Include patterned or embossed treads, safety coated treads, railing system, handrails, and handrail brackets.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Type and Manufacture: Provide steel stairs of the following types as indicated:
1. Concrete Pan-Filled Stairs: Steel pan-type stairs with concrete-filled treads and landings, and with treads, risers, and platforms constructed of structural steel sheet. Treads shall have nosings.
 2. Industrial Type Stairs: Steel stairs with tread fabricated from checkered or diamond-pattern steel plate or sheet, or with treads fabricated from button-embossed structural steel sheet. Risers shall be closed, fabricated from steel sheet.
 3. Safety Tread Stairs: Steel stairs with formed steel treads and platforms, coated with anti-skid safety surface, and closed steel sheet risers.
 4. Railing System: All stairs shall be provided with a complete stair railing system, including handrails and handrail brackets at walls, fabricated from steel pipe.
- B. Stringers and Supporting Steel:
1. Structural Shapes: Standard structural sections, as indicated, conforming to ASTM A36/A36M.
 2. Structural Tubing: Welded or seamless steel tubing, conforming to ASTM A500 or ASTM A501 (minimum yield point of 33,000 psi), of size and shape indicated.
- C. Treads and Risers, Platforms and Landings:
1. Steel Sheet: Treads, risers, and platforms shall be fabricated from structural steel sheet, of gage or thickness indicated, conforming with ASTM A570/A570M or ASTM A611, with minimum yield point of 33,000 psi, formed as indicated. When gage is not indicated, provide 14 gage steel sheet.
 2. Patterned Steel Plate: Treads and platforms for industrial-type closed-riser stairs shall be commercial quality checkered or diamond-pattern steel plate or structural steel sheet of thickness indicated, formed to shape and configuration indicated. Risers shall be steel sheet as specified above. Treads and platforms shall be hot-dip galvanized after fabrication in accordance with ASTM A123.
 - a. Button-Embossed Steel Sheet: Treads and platforms may be fabricated from button-embossed structural steel sheet of minimum 12 gage thickness, with punched circular holes at apex of buttons for nonslip effect, and punched circular holes between buttons for drainage. Buttons shall be spaced 5/8 inch on centers. Drainage

holes shall be spaced 1-1/4 inches on centers, eliminating the buttons at these locations. Hole size for button holes shall be 1/8-inch diameter, plus or minus 1/32 inch. Hole size for drainage holes shall be 1/4-inch diameter, plus or minus 1/16 inch. Treads and platforms shall be hot-dip galvanized after fabrication in accordance with ASTM A123.

3. Safety Coated Treads: Formed steel sheet coated with anti-skid or nonslip encapsulated aluminum oxide material bonded or fused to the steel surface. Submit product data and sample for approval.

D. Railings and Handrails:

1. Pipe: Pipe for railings, pipe supports, and handrails shall be seamless steel pipe conforming to ASTM A53, Type S, Grade A, with special instructions to the manufacturer to provide Architectural Handrail Grade, of diameters and sizes indicated.
2. Handrail Brackets: Provide handrail brackets for handrails at walls, manufactured specifically for the purpose of cast, forged, or wrought steel, of configuration indicated or required to suit conditions, galvanized after fabrication.

E. Welding Rod/Electrodes: Refer to Section 05 05 22 - Metal Welding, for requirements.

F. Anchors, Fasteners, and Accessories: Provide all required anchors, fasteners, miscellaneous components, and accessories as required for a complete and finished stair installation. Bolts, nuts, and washers shall conform with ASTM A307, galvanized in accordance with ASTM A153.

1. Expansion Bolts: Where anchors are not cast into the concrete construction, provide galvanized expansion type anchors with matching galvanized steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts. Expansion bolts require approval of the Engineer before they may be installed in post-tensioned slabs. Expansion bolts will not be permitted for use on concrete curbs or along the edge of concrete or a concrete joint.

G. Paint: Corrosion-inhibitive protective primer as specified in Article 2.04 herein.

H. Grout: Refer to Section 03 61 11 - Non-Shrink Grout, for requirements.

2.02 FABRICATION

A. Metal stairs and railings shall be fabricated by firms or shops experienced and skilled in the construction of metal stairs and architectural railings. There shall be no exposed screws, bolts, and fasteners in the finished work.

B. For items bearing on concrete, provide steel bearing plates and anchors as indicated or required. Base or bearing plates shall be leveled by means of adjustment nuts. The space below plates shall be packed solid with full bed of non-shrink grout. Templates shall be furnished, together with instructions for setting of anchors, anchor bolts, and bearing plates. The Contractor shall supervise and ensure that anchors and related items are properly set in concrete during the progress of the work.

METAL STAIRS

- C. Welded connections shall be made in accordance with applicable requirements of Section 05 05 22 - Welding. Welding shall be performed in the shop, unless otherwise indicated. Welds where exposed to view shall be ground down and dressed smooth, so that the shape and profile of the item welded are maintained.
- D. Holes shall be cut, drilled, or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Holes in base or bearing plates shall be drilled. Holes shall be provided in members as required to permit connecting the work of other trades.
- E. Metal stairs and railings shall be prefabricated and preassembled in the factory or shop as far as practicable.

2.03 GALVANIZING

- A. Where certain components are indicated to be galvanized, comply with galvanizing requirements of Section 05 50 00 - Metal Fabrications.

2.04 CLEANING AND PAINTING

- A. Cleaning and painting shall conform to like requirements specified in Section 05 12 00 - Structural Steel Framing.
- B. All surfaces of metal stairs and railings, including surfaces of pan-filled stairs, shall be cleaned and treated to assure maximum paint adherence, prior to application of the shop prime coat, in accordance with SSPC-SP 1, SSPC-SP 3, SSPC-SP 10, and SSPC-SP 11 as applicable for the exposure and application.
- C. Ferrous metalwork shall be given a shop coat of rust-inhibitive metal primer as specified in Section 05 12 00 - Structural Steel Framing, or other approved rust-inhibitive metal primer standard with the stair manufacturer. All surfaces of stairwork and railings shall be spray-painted.
- D. Where galvanized surfaces are indicated to be painted, comply with cleaning and painting requirements of Section 05 50 00 - Metal Fabrications.
- E. Coordinate with Section 09 91 00 - Painting, for compatibility of the prime coat and finish coats of paint.

2.05 CONCRETE

- A. Concrete for pan-filled stair treads and landings shall be concrete, weighing not less than 120 pounds per cubic foot, with a minimum compressive strength at 28 days of 4,000 psi. Maximum aggregate size shall be 3/8 inch (ASTM C33, Size No. 8). Include a mix of aluminum oxide and silicone carbide grit particles as required to produce non-slip tread surfaces.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Stairs and railings shall be installed by the manufacturer or its authorized representative as indicated and in accordance with the approved Shop Drawings and the manufacturer's installation instructions. Stairs and railings shall be installed with all accessories furnished by the manufacturer or fabricator as required for complete and finished stair installations.
- B. Installation of stair work shall be true and horizontal or perpendicular as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.
- C. Shop fabricated items subject to damage shall be braced and carefully handled to prevent distortions or other damage.
- D. Field welding, where required, shall conform with requirements specified for shop fabrication.
- E. Bearing plates shall be supported at the proper level by means of adjustment nuts on anchor bolts. Bases and plates shall be set accurately using a high-strength, non-shrink grouting mortar to obtain uniform bearing.

3.02 FIELD PAINTING

- A. After installation, exposed painted surfaces, field welds, and other abraded or damaged primed surfaces shall be touched up with an additional coat of the same primer for ferrous surfaces as herein before specified for shop painting. Spray paint all touch-up work.
- B. Finish field painting is specified in Section 09 91 00 - Painting.

3.03 CONCRETE WORK

- A. Concrete for pan-filled stairs shall be placed, compacted, finished, and cured in accordance with applicable requirements of ACI 301.
- B. Treads and landings shall receive a "troweled finish" in combination with a "nonslip finish" with "very flat" tolerances as specified in ACI 301 and ACI 117.

END OF SECTION 05 51 00

SECTION 05 52 00

METAL RAILINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal Handrails
- B. Steel Pipe
- C. Steel Plate

1.02 RELATED SECTIONS

- A. Metal handrails and railings related directly to metal stairs are specified in Section 05 51 00 - Metal Stairs.
- B. Stainless steel handrails and railings are specified in Section 05 70 00 - Decorative Metal.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Metal handrails and railings will be measured for payment by the lump-sum method, acceptably fabricated and installed.
- B. Payment: Metal handrails and railings will be paid for at the indicated Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36 Specification for Structural Steel
 - 2. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
 - 3. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 4. ASTM A143 Recommended Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
 - 5. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 6. ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
 - 7. ASTM A384 Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies

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8. ASTM A385 Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
9. ASTM A449 Specification for Quenched and Tempered Steel Bolts and Studs
10. ASTM A563 Specification for Carbon and Alloy Steel Nuts
11. ASTM A780 Practice for Repair of Damaged Hot-Dip Galvanized Coatings
12. ASTM D2092 Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Paint

B. National Association of Architectural Metal Manufacturers (NAAMM):

1. "Pipe Railing Manual, Including Round Tube"

C. Steel Structures Painting Council (SSPC):

1. SSPC-SP 1 Solvent Cleaning
2. SSPC-SP 3 Power Tool Cleaning
3. SSPC-SP 10 Near-White Blast Cleaning
4. SSPC-SP 11 Power Tool Cleaning to Bare Metal

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit detailed Shop Drawings of metal handrails and railings, showing sizes, details of fabrication and construction, bends and radii, handrail brackets, locations of hardware, anchors, and accessories, and installation details.
- C. Product Data: Submit manufacturers' product data of railing system and railing components, handrails, and handrail brackets. Include corrosion-inhibitive shop coat painting system.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal Handrails: Standard Steel Pipe, Architectural Handrail Grade, of diameter and sizes indicated. Exterior metal handrails shall be galvanized. Provide terminal safety returns for all stair handrails. Handrail brackets shall be galvanized malleable iron, manufactured for the purpose, for anchorage to concrete walls. Include all fittings and components, sleeves, hardware, backing plates, and accessories as required for complete and finished handrail installations.

- B. Steel Pipe: Pipe for railings, pipe supports, and pipe sleeves shall be seamless steel pipe, conforming to ASTM A53, Type S, Grade A, of diameters and sizes indicated. Special instructions shall be given the pipe manufacturer to provide Architectural Handrail Grade pipe.
- C. Plate: Steel plate for anchor plates shall be standard steel plate, conforming to ASTM A36, weldable quality.
- D. Welding Rod/Electrodes: Refer to Section 05 05 22 - Metal Welding, for requirements.
- E. Anchors, Fasteners, and Accessories: Provide all required anchors, fasteners, miscellaneous components, and accessories as required for complete and finished railing installations. Bolts and studs, nuts, and washers shall conform with ASTM A307, A449, and A563, as applicable, and shall be galvanized in accordance with ASTM A153.
 - 1. Expansion Bolts: Where anchors are not included in the concrete construction, provide galvanized expansion type anchors with matching galvanized steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts. Expansion bolts require approval of the Engineer before they may be installed in post-tensioned slabs. Expansion bolts will not be permitted for use on concrete curbs or along the edge of concrete or a concrete joint.
- F. Paint: Corrosion-inhibitive protective metal primer as herein specified under "Cleaning and Painting."
- G. Grout: Refer to Section 03 61 11 - Non-Shrink Grout, for requirements.

2.02 FABRICATION

- A. Metal handrails and railings shall be fabricated by firms or shops experienced and skilled in the custom fabrication of architectural metal handrails and railings, and shall meet the quality requirements of NAAMM's Pipe Railing Manual.
- B. Bends in rails shall be precision-formed to a smooth continuous radius by skilled workers. Work quality and finish shall be true to detail. Butt joints shall have internal pipe sleeve or dowel. Ends shall be closed with similar materials, welded and ground smooth.
- C. Steel welded connections shall be made in accordance with applicable requirements of Section 05 05 22 - Metal Welding. Welding shall be performed in the shop unless otherwise indicated. Welded joints of handrails and railings shall be ground and dressed smooth to match adjacent surfaces and so that the shape and profile of the item welded is maintained.
- D. Metal handrails and railings shall be prefabricated and preassembled in the factory or shop as far as practicable.

2.03 GALVANIZING

- A. Ferrous metal railings and related items on the exterior of the building, or as otherwise indicated, shall be galvanized, after fabrication, by the hot-dip process in accordance with ASTM A123 and ASTM A385. Weight of zinc coating shall conform with requirements specified under "Weight of Coating" in ASTM A123.

METAL RAILINGS

- B. Safeguarding against steel embrittlement shall conform with applicable requirements of ASTM A143.
- C. Safeguarding against warpage and distortion of steel members shall conform with applicable requirements of ASTM A384.
- D. Shop galvanized metalwork necessitating field welding which in any manner removes original galvanizing shall be restored by galvanizing repair in accordance with ASTM A780.
- E. Bolts and screws for attachment of galvanized items shall be galvanized in accordance with ASTM A153, or of compatible, non-corrodable material.

2.04 CLEANING AND PAINTING

- A. Cleaning and painting shall conform to like requirements specified in Section 05 12 00 - Structural Steel Fabrication, and Section 05 50 00 - Metal Fabrications.
- B. All surfaces of metal handrails and railings shall be cleaned and treated to assure maximum paint adherence, prior to application of the shop prime coat, in accordance with SSPC-SP 1, SSPC-SP 3, SSPC-SP 10, SSPC-SP 11 as applicable for the type of substrate, exposure, and application.
- C. Ferrous metalwork shall be given a shop coat of rust-inhibitive metal primer as specified in Section 05 12 00 - Structural Steel Framing, or other approved rust-inhibitive metal primer standard with the railing manufacturer. All surfaces of handrails and railings shall be spray-painted.
- D. Where galvanized surfaces are indicated to be painted, comply with cleaning and painting requirements of Section 05 50 00 - Metal Fabrications.
- E. Coordinate with Section 09 91 00 - Painting, for compatibility of the prime coat and finish coats of paint.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install metal handrails and railings as indicated and in accordance with the approved Shop Drawings, using workers skilled and experienced in the installation of the type of work involved. Conform with the installation requirements of NAAMM's Pipe Railing Manual, as applicable.
- B. Install metal handrails and railings with accessories furnished by the railing fabricator as required for complete and finished railing installations.
- C. Installation of handrails and railings shall be in accordance with approved Shop Drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.
- D. Field welding, where required, shall conform with requirements of Section 05 05 22 - Metal Welding.

METAL RAILINGS

- E. Where railing base plates require grouting, conform with requirements of Section 03 61 11 - Non-Shrink Grout, and Section 05 12 00 - Structural Steel Framing, as applicable.

3.02 GALVANIZING REPAIR

- A. Galvanized surfaces which have become damaged from welding, handling, or installation shall be repaired immediately after installation with galvanizing repair material in accordance with ASTM A780.

3.03 FIELD PAINTING

- A. After installation, exposed painted surfaces, field welds, and other abraded or damaged primed surfaces shall be prepared as required and touched up with an additional coat of the same primers for ferrous and galvanized surfaces as hereinbefore specified for shop painting.
- B. Lightly sand and feather out such damaged surfaces so that paint touch-up becomes invisible. Spray-paint all touch-up work.
- C. Finish field painting is specified in Section 09 91 00 - Painting.

END OF SECTION 05 52 00

BART Facilities Standards (BFS)

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SECTION 05 70 00

DECORATIVE METAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Stainless steel composite panels
- B. Fire hose cabinets
- C. Stainless steel service gates and barriers
- D. Map, schedule, and advertising frames
- E. Windscreen assemblies
- F. PABX telephone enclosures
- G. Public telephone carrels
- H. Stainless steel handrails and railings
- I. Perforated ceiling panels

1.02 RELATED SECTIONS

- A. Welding of stainless steel is specified in Section 05 05 22 - Metal Welding.
- B. Metal handrails and railings related directly to service stairs are specified in Section 05 51 00 - Metal Stairs.
- C. Painted ferrous and galvanized handrails and railings are specified in Section 05 52 00 - Metal Railings.
- D. Manufactured stainless steel fire extinguisher cabinets are specified in Section 10 40 00 - Safety Specialties.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement
 - 1. Decorative metalwork will be measured for payment by the lump-sum method, acceptably fabricated and installed.
 - 2. All items of materials, hardware, fasteners, accessories, incidentals, and their installation will be considered as included in the lump-sum unit measurement.
- B. Payment: Decorative metalwork will be paid for at the Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES**A. American National Standards Institute (ANSI):**

1. ANSI Z97.1 Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test

B. American Society for Testing and Materials (ASTM):

1. ASTM A240 Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
2. ASTM A269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
3. ASTM A312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe
4. ASTM A480 Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
5. ASTM C1048 Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass
6. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
7. ASTM F593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
8. ASTM F594 Specification for Stainless Steel Nuts
9. ASTM F837 Specification for Stainless Steel Socket Head Cap Screws
10. ASTM F879 Specification for Stainless Steel Button and Flat Countersunk Head Cap Screws
11. ASTM F880 Specification for Stainless Steel Socket - Set Screws

C. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 503 Finishes for Stainless Steel Pipe Railing Manual, Including Round Tube

D. Specialty Steel Industry of North America (SSINA):

1. "Designer Handbook" series including the following industry standards:

Design Guidelines for the Selection and Use of Stainless Steel, as follows:
 Specifications for Stainless Steel
 Finishes for Stainless Steel

Fabrication of Stainless Steel
Stainless Steel Fasteners

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit detailed Shop Drawings of decorative metalwork, showing sizes, details of fabrication and construction, handrail brackets, locations of hardware, anchors, and accessories, and installation details.
- C. Product Data: Submit manufacturers' product data of manufactured items and for miscellaneous hardware items associated with decorative metalwork.
- D. Samples: Submit samples of stainless steel finishes for the different locations. Pipe and tube shall be submitted in 10-inch lengths; sheet shall be submitted in 8-inch by 10-inch size.
- E. Selected decorative metal components shall match the Engineer's control samples in quality of fabrication, joinery, welding, and finish.

1.06 QUALITY ASSURANCE

- A. Work Quality:
 - 1. Shop and field work shall be performed by mechanics, craftspersons, artisans, and workers skilled and experienced in the fabrication and installation of the decorative metalwork involved.
 - 2. Stainless steel work shall conform with the quality requirements of the herein referenced Specialty Steel Industry of North America, "Designer Handbook" series standards. Pipe and tube railings shall conform with NAAMM "Pipe Railing Manual, including Round Tube."
- B. Iron Contamination (Rust): Stainless steel with iron contamination will not be accepted. Dies for forming stainless-steel components shall be stainless steel or chrome-plated to prevent embedment of minute iron particles. All stainless-steel work shall be polished and cleaned after fabrication and installation to prevent rusting susceptibility.
- C. Welds of Stainless Steel: Exposed welds shall be ground smooth and polished to match the adjacent surrounding finish of the stainless steel.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Stainless Steel Tube or Pipe: Provide stainless steel tube or pipe, where indicated, conforming to ASTM A269, Grade TP316, or ASTM A312, Grade TP316, of diameters and sizes indicated. Provide tube or pipe with a polished finish similar to NAAMM AMP 503 No. 4 finish. Tube or

pipe shall receive a final polishing using grit no coarser than 180 grit. Ends shall be closed with matching material, welded, and ground smooth.

1. Handrails: Provide terminal safety returns for all handrails. Handrail brackets shall be stainless steel, wrought or welded, manufactured for the purpose, for anchorage to indicated substrate. Handrail brackets shall comply with applicable code and loading requirements. Finish of brackets shall match handrail finish. Include all fittings and components, sleeves, hardware, backing plates, and accessories as required for complete and finished handrail installations.
 2. Railing Corners: Provide one-quarter sphere components for rounding of 90-degree, outside railing corners. Sphere components shall be welded into position, and the weldments shall be ground and dressed smooth so as to be invisible in the finished work.
- B. Stainless Steel Sheet and Plate: ASTM A240 and ASTM A480, Type 316, of thickness indicated, with ASTM A480 or NAAMM AMP 503 No. 4 polished finish.
- C. Anchor Plates: Provide stainless steel anchor plates conforming to ASTM A240 and ASTM A480, Type 316, with ASTM A480 or NAAMM AMP 503 No. 4 polished finish.
- D. Welding Rod/Electrodes: Refer to Section 05 05 22 - Metal Welding, for requirements. Provide stainless steel welding electrodes.
- E. Anchors, Fasteners, and Accessories: Provide all required anchors, fasteners, miscellaneous components, and accessories as required for complete and finished decorative metal installations. Bolts, studs, and nuts shall conform with ASTM F593, F594, F837, F879, and F880 as applicable, Type 316. Comply also with applicable requirements of SSINA's "Stainless Steel Fasteners." Anchors and fasteners shall be tamper-resistant where exposed.
1. Self-Tapping Screws, Washers and Shims: Oval head, counter-sunk phillips self-tapping screws, washers, and horseshoe shims shall consist of a 316 stainless steel alloy.
 2. Expansion Bolts: Where anchors are not included in the concrete or masonry construction, provide stainless steel expansion type anchors with matching stainless steel bolts or studs with nuts, of sizes as indicated or required to meet installation conditions. Provide stainless steel washers under all bolt heads and nuts. Expansion bolts require approval of the Engineer before they may be installed in post-tensioned slabs. Expansion bolts will not be permitted for use on concrete curbs or along the edge of concrete or a concrete joint.
- F. Grout: Refer to Section 03 61 11 - Non-Shrink Grout, for requirements.
- G. Glass: Refer to Section 08 80 00 - Glazing, for glass and glazing requirements, including quality assurance provisions for heat-strengthened and tempered glass.

2.02 FABRICATION

- A. Decorative metalwork shall be fabricated by firms or shops experienced and skilled in the custom fabrication of architectural decorative metalwork. Form and fabricate the work as indicated and as required to meet installation conditions.

- B. Bends in tubes or pipes shall be precision-formed to a smooth continuous radius by skilled workers, true to detail. Butt joints shall have tight-fitting internal pipe sleeve or dowel.
- C. Butt joints in stainless steel pipe or tube railings shall not be welded. Instead, railing joints shall have internal, tight-fitting stainless steel sleeve, secured with tamper-resistant, counter-sunk stainless steel fasteners, located at the railing bottom. Butt joints in railings shall be precision-manufactured to provide tight hairline joints, slightly eased at edges to eliminate burrs and sharp edges. Provide for expansion and contraction at joints when railings exceed runs of 40 feet in length.
- D. Stainless steel welded connections shall be made in accordance with applicable requirements of Section 05 05 22 - Metal Welding. Welding shall be performed in the shop unless otherwise indicated. Welded joints shall be ground and dressed smooth to match adjacent surfaces and so that the shape and profile of the item welded is maintained and so that the weld seam is invisible in the finished work. Welds shall be ground and polished to match NAAMM AMP 503 No. 4 finish.
- E. Decorative metalwork shall be prefabricated and preassembled in the factory or shop as far as practicable.
- F. All stainless steelwork, after receiving NAAMM AMP 503 No. 4 polished finish, shall receive a final polishing using non-ferrous grit no coarser than 180.

2.03 STAINLESS STEEL COMPOSITE PANELS

- A. Materials: Provide stainless steel panels and cladding, as indicated, constructed of composite panels, consisting of stainless steel sheet and backing (balancing) sheet laminated to an inner core. Comply with the following requirements:
 - 1. Stainless Steel Sheet: ASTM A240 and ASTM A480, Type 316, with ASTM A480 or NAAMM AMP 503 No. 4 polished finish. Construct all face joints flush, continuously welded, ground and polished smooth. Metal gage shall be as indicated. Where metal gage is not indicated, provide minimum thickness of 18 gage.
 - 2. Core: Cement-bonded particle board inner-core panel of thickness indicated. Inner-core panel shall meet the following requirements:

a.	Density	76 pounds per cubic foot
b.	Modulus of Rupture	1300 to 1900 psi
c.	Modulus of Elasticity	725,000 psi
d.	Compressive Strength	2180 psi
e.	Moisture Content	9 percent, plus or minus 3 percent
f.	Surface Burning	5 flame spread
	Characteristics when tested in accordance with ASTM E84	0 smoke developed 0 fuel contributed
g.	Swelling resulting from water immersion	0.86 percent thickness 0.12 percent length

for 24 hours
(18mm thick board) 0.07 percent width

3. Backing (Balancing) Sheet: Backing sheet shall be stainless steel of same type, metal gage, and finish of the exposed face sheet. All panels shall be fabricated with backing sheet. Where backing sheet will be concealed in the finished work, the finish may be a nonpolished mill finish.
 4. Adhesive: Type I waterproof glue, manufactured for, and capable of, veneering stainless steel and galvanized steel sheet to core material.
- B. Assembly: Laminate stainless steel sheets to the inner core material with adhesive applied over full contact area in accordance with adhesive manufacturer's instructions. Apply under pressure. Close all contact edges tight at corner joints, continuously weld, grind, and dress smooth. Refinish and polish all welds to match adjacent No. 4 finish.
- C. Cutting of panel edge will not be acceptable.

2.04 FIRE HOSE CABINETS

- A. Cabinet Body and Door: Provide cabinet body and door, constructed of a composite panel consisting of stainless steel sheets laminated to an inner core, as follows:
1. Stainless Steel Sheets: ASTM A240 and ASTM A480, Type 316, with ASTM A480 or NAAMM AMP 503 No. 4 polished finish. Construct all face joints flush, continuously welded, ground and polished smooth. Metal gage as indicated.
 2. Core: Cement-bonded particle board inner-core panel as specified in Article 2.03 herein for stainless steel composite panels, of thickness indicated.
 3. Assembly: Laminate stainless steel sheets to both sides of the inner-core panel with adhesive applied over full contact area in accordance with adhesive manufacturer's instructions. Close all contact edges tight at corner joints, provide continuous weld, grind, and dress smooth.
 4. Angles: Stainless steel, ASTM A240 and ASTM A480, Type 316, with ASTM A480 or NAAMM AMP 503 No. 4 polished finish where exposed.
 5. Gasket: Adhesive applied, weatherproof closed-cell, expanded neoprene gasket, 1/4 inch thick, on cabinet enclosure for sealing door perimeter.
- B. Hinges: Stainless steel full length, heavy-duty piano-type, meeting the requirements of ASTM A240 and A480, Type 316, minimum 14 gage.
- C. Latch: Stainless steel and brass, flush type, with spring-loaded catch activated by a pull device. Latch shall be replaceable, vandal-resistant screw mounted.

D. Cabinet Identification:

1. Cabinets shall be labeled with the words "FIRE EXTINGUISHER" and "FIRE HOSE" in one inch high letters, Univers 65 style.
2. Lettering shall be engraved in a separate stainless steel plate that is mounted on the cabinet door. The Letters shall be filled with exterior sign enamel, black as selected by the Engineer.
3. Stainless-steel plate shall have all edges chamfered and shall be secured with tamper-resistant stainless steel fasteners or permanent adhesive.

2.05 SERVICE GATES, GUARDRAILS, AND BARRIERS

- A. Fabricate top and bottom rails from stainless steel tube or pipe, as indicated, conforming to ASTM A269, Grade TP316, or ASTM A312, Grade TP316. Fabricate pickets or balusters from stainless steel square tube or bars, as indicated, Type 316.
- B. Neatly cope intersections, fully weld, grind, and polish smooth. Heat curves and blend smoothly without visible distortion of cross section. Provide rounded corners at outside railing corners as herein specified under "Materials."
- C. Gate hinge shall be a floor-mounted, center-hung, double-acting, non-handed closer in a 4-1/16 inch deep steel case with minimum 0.042 inch thick stainless steel cover plate, ASTM A240 and ASTM 480, Type 316, with ASTM A480 or NAAMM AMP 503 No. 4 finish. Top pivot shall have an oilite bearing for recovering stainless steel pin. Complete assembly shall be handicapped accessible. Comply with Engineer's control sample.
- D. Provide positive stop and latch where indicated. Comply with Engineer's control sample.

2.06 MAP, SCHEDULE, AND ADVERTISING FRAMES

- A. Frame Units: Fabricate from stainless steel pipe conforming to ASTM A312, Grade TP316. Form 90 degree elbows by mitering and continuously welding a stainless steel one-quarter sphere to a cut-out area of the pipe as herein specified under "Materials." Neatly cope intersections, fully weld, and grind smooth and flush.
- B. Glazing: Two panes of tinted tempered and laminated glass, ASTM C1048, Kind FT, Type I, Class 1, Quality q3, and ANSI Z97.1. Lamination interlayer shall be a minimum of 0.30 inch thick polyvinyl butyral. Size as indicated. Glass shall be set in stainless steel stops with glazing tape consisting of synthetic rubber sheet or strip material reinforced and stabilized with fabric mesh in center and treated with a bonding agent on both contact surfaces.
- C. Hinge: Stainless steel full length, heavy-duty piano-type, meeting the requirements of ASTM A240 and ASTM A480, Type 316, minimum 14 gage.
- D. Lock: Cylinder type, CAT 74, compatible with BART's keying system. Comply with the Engineer's control sample.

2.07 WINDSCREEN ASSEMBLIES

- A. Interface and Coordination: Coordinate construction with precast concrete bench details. Refer to Section 03 40 00 - Precast Concrete, for requirements.
- B. Fabrication: Fabricate from stainless steel pipe conforming to ASTM A312, Grade TP316. Form 90 degree elbows by mitering and continuously welding a stainless steel one-quarter sphere to a cut-out area of the pipe as herein specified under "Materials." Neatly cope intersections, fully weld, and grind smooth and flush, and polish to match adjacent finish surfaces.
- C. Glazing: Provide two panes of tinted tempered and laminated glass, ASTM C1048, Kind FT, Type I, Class 1, Quality q3, and ANSI Z97.1. Lamination interlayer shall be a minimum of 0.30 inch thick polyvinyl butyral. Provide glass of size and thickness indicated. Dry set glass with structural glazing gasket consisting of a single piece neoprene unit that seals with an interlocking neoprene strip after unit grips the glass and frame nib.
- D. Precast Concrete Bench Components: Refer to Section 03 40 00 - Precast Concrete, for requirements.
- E. Stainless Steel Composite Panels: Comply with requirements of Article 2.03 herein.

2.08 PABX PHONE ENCLOSURE

- A. Cabinet Body: Stainless steel, ASTM A240 and ASTM A480, Type 316, with ASTM A480 or NAAMM AMP 503 No. 4 polished finish. Construct all face joints flush, continuously welded, ground and polished smooth. For composite panels, refer to Article 2.03 herein for requirements.
- B. Angles: Stainless steel, ASTM A240 and ASTM 480, Type 316, with ASTM A480 or NAAMM AMP 503 No. 4 polished finish where exposed.
- C. Hinges: Stainless steel, full-length, heavy-duty piano-type, meeting requirements of ASTM A240 and ASTM A480, Type 316, minimum 14 gage.
- D. Lock: Cylinder type, CAT 74, compatible with BART's keying system. Comply with the Engineer's control sample.
- E. Gasket: Apply a weatherproof closed-cell expanded neoprene gasket with adhesive to cabinet enclosure to seal door perimeter.
- F. Assembly: Close all contact edges tight at corner joints, continuously weld, grind, and dress smooth.
- G. Installation: Pre-drill holes for anchorage.

2.09 PUBLIC TELEPHONE CARREL

- A. Fabrication: Fabricate from stainless steel tube or pipe as indicated. Form 90-degree elbows by continuously welding a stainless steel one-quarter sphere to a cut-out area of the pipe as herein specified under "Materials." Neatly cope intersections, fully weld, and grind smooth and flush.

- B. Acoustical Panel: Perforated stainless steel, 16 gage, ASTM A240 and ASTM A480, Type 316, with ASTM A480 or NAAMM AMP 503 No. 4 polished finish, with sound absorptive black fiberglass ductliner-type backing.
1. Sound-Absorptive Insulation: Panels shall be backed up with ductliner-type insulation board fitted snugly and continuously within the panel's turned-in or turned-up edges. Insulation board shall conform with the following requirements:
 - a. Insulation board shall be manufactured from resin-bonded fibrous glass specifically for duct systems with integral vapor barrier. Nominal thickness: one inch. Color: black.
 - b. Insulation board shall have a flame-spread rating of 25 or less and a smoke-developed contribution of 5 or less when tested in accordance with ASTM E84, and shall be able to withstand 2 inches of static pressure.
- C. Wiring and Conduits: All wiring and conduits shall be concealed. Exposed wiring and conduits will not be permitted.

2.10 HANDRAILS AND RAILINGS

- A. Handrails and Railings: Stainless steel tube or pipe as herein specified under "Materials" and "Fabrication".
- B. Metal Components and Accessories: Stainless steel, Type 316, of configurations and sizes indicated.
- C. Handrail Brackets: Provide manufactured 300 Series stainless steel handrail brackets with proper anchorage hardware for adjoining construction.

2.11 PERFORATED CEILING PANELS

- A. Stainless Steel Perforated Sheet: No. 16 gage, Type 316 stainless steel with IPA No. 108 pattern perforated sheet, consisting of 5/64-inch diameter holes on 1/8-inch centers, in staggered configuration creating 36 percent open area. Provide and fabricate without border area. Provide with No. 4 polished finish.
- B. Fabrication: Fabricate ceiling panels accurately to the sizes and configurations indicated. Provide turned up and returned edges for all panels as indicated. Panels shall be fabricated to be removable. Provide finished holes for fasteners to ceiling framing system.
- C. Insulation: Ceiling panels shall be backed up with duct liner-type insulation board fitted snugly and continuously within the panel's turned up edges. Insulation board shall conform with the following requirements:
 1. Insulation board shall be manufactured from resin-bonded fibrous glass specifically for duct systems with integral vapor barrier. Nominal thickness: one inch. Color: black.

2. Insulation board shall have a flame-spread rating of 25 or less and a smoke-developed contribution of 5 or less when tested in accordance with ASTM E84, and shall be able to withstand 2 inches of static pressure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install decorative metalwork as indicated and in accordance with the approved Shop Drawings, using workers skilled and experienced in the installation of the type of work involved.
- B. Install metal handrails and railings with installation accessories furnished by the railing fabricator as required for complete and finished railing installations.
- C. Install decorative metalwork true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.
- D. Field welding, where required, shall conform with requirements specified herein for shop welding under "Fabrication." All welds shall be ground and polished smooth to match adjacent finish surfaces.

3.02 CLEANING OF STAINLESS STEEL

- A. All stainless steelwork shall be cleaned of all dirt, dust, oil and grease, fingerprints, atmospheric and aqueous corrosion, and iron contamination, rinsed with clear water, and then polished before the Engineer's final inspection that establishes Substantial Completion of the Contract.
- B. The cleaning method shall be the mildest treatment necessary for the problem. For example: a solution of soap, detergent, or ammonia and water, applied with a sponge and rinsed with clear water. If this method is inadequate, then the next stronger method shall be tried, progressively, until satisfactory results are obtained.
- C. Heavy dirt, grease, and oil shall be removed with organic solvents or degreasing agents and then thoroughly rinsed with clear water.
- D. Corrosion shall be removed by scouring lightly with an abrasive cleaner, rubbing in the direction of the finish grain of the metal. In cases of extreme discoloration, use scouring sponges or steel wool, made only from stainless steel, and then rinsed thoroughly with clean water.
- E. Iron contamination shall be removed by passivation, a chemical cleaning method involving the use of nitric acid. This cleaning method shall be performed in the shop only, unless no other treatment at the site is successful. Passivation treatment at the site shall be performed under the continuous supervision of the stainless steel fabricator, employing all required safety precautions and protection of adjacent surfaces.
- F. Weldments may require additional fine grinding to remove corrosion or iron contamination if no other cleaning method is successful.

DECORATIVE METAL

- G. All cleaned and rinsed stainless steelwork shall be dried with clean towels and then polished by buffing. If a dull or satin finish is indicated, then buff only enough to remove any remaining residue.

END OF SECTION 05 70 00

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5.6 Division 6

Wood, Plastics, and Composites

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wood Nailers, Backing and Blocking
- B. Anchors and Fasteners

1.02 RELATED SECTIONS

- A. Concrete formwork and falsework are specified in the applicable Sections under Division 3 - Concrete.
- B. Blocking and backing associated with cabinets and cabinetwork are specified in Section 06 41 00 - Architectural Wood Casework.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Rough carpentry and related rough hardware therefore will not be measured separately for payment.
- B. Payment: Rough carpentry and related rough hardware will be paid for as part of the Contract unit price or Contract lump-sum price for the associated work requiring rough carpentry work as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American Plywood Association (APA):
 - 1. U.S. Product Standard PS 1 for Construction and Industrial Plywood
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
- C. American Wood Preservers Association (AWPA):
 - 1. AWPA C2 Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
 - 2. AWPA C20 Structural Lumber, Fire-Retardant Pressure Treatment
 - 3. AWPA C27 Plywood, Fire-Retardant Pressure Treatment

- D. Federal Specifications (FS):
 - 1. TT-W-550 Wood Preservative, Chromated Copper Arsenate Mixture
 - 2. TT-W-571 Wood Preservation: Treating Practices
- E. West Coast Lumber Inspection Bureau (WCLB):
 - 1. WCLB No. 17 Standard Grading Rules

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.
- B. Certification: Provide AWWA grade-stamped pressure-treated wood and plywood as specified herein, or submit certification by the fire-retardant pressure-treating plant that pressure-treated wood and plywood comply with the specified reference standards.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Keep wood products under cover and dry. Protect against exposure to moisture and contact with damp or wet surfaces. Stack material in a manner that promotes air circulation.

PART 2 - PRODUCTS

2.01 WOOD NAILERS, BACKING, AND BLOCKING

- A. Wood nailers or nailing strips, backing, and blocking shall be "Construction" or "No. 1" grade Douglas fir as defined in WCLB No. 17, of size and dimensions indicated or required. Moisture content shall not exceed 19 percent at time of installation.
 - 1. Fire Retardant Treatment: Wood nailers, backing, and blocking shall be pressure-impregnated with an AWWA C20 fire-retardant chemical suitable for the purpose. Each treated member shall be stamped with the AWWA approved trademark and, in addition, the Classification Marking of the Underwriters Laboratories, Inc. for Fire Hazard Classification shall be affixed to the back of each member. Wood nailers and blocking members shall be pre-cut to size and shape before being treated to preclude the need for field cutting and thus exposing untreated surfaces at cut ends. Any members that must still be cut in the field shall be dipped, after cutting, in the same fire-retardant chemical that was used in the pressure treating process.
 - 2. Preservative Treatment: Where wood members are indicated or required to be treated with preservative material, provide pressure-treated "Construction" or "No. 1" grade Douglas fir, treated in accordance with FS TT-W-550 for preservative material (CCA) and FS TT-W-571 or AWWA C2 for pressure treating.
- B. Plywood shall be Group 1 Species meeting requirements of U.S. Product Standard PS-1, of sizes and thicknesses indicated or required. Minimum thickness shall be 5/8 inch. Each panel shall carry the APA grade trademark. Plywood shall be Exterior Grade or manufactured with Exterior

Glue, with C-C or C-D (plugged) faces.

1. Fire-Retardant Treatment: Plywood shall be fire-retardant treated in accordance with AWWPA C27 to have a flame spread rating of less than 25 when tested in accordance with ASTM E84. Comply also with applicable requirements specified above for wood nailers and blocking.

2.02 ANCHORS AND FASTENERS

- A. Wood nailers, backing, and blocking shall be anchored to metal decking with self-drilling, self-tapping, tempered steel screws manufactured for the purpose of securing items to metal decking.
- B. Wood and plywood backing and blocking shall be secured to metal framing for gypsum board walls and partitions with self-drilling, self-tapping tempered steel drywall screws of type and size required for the installation.
- C. Toggle bolts or screws may be employed to secure wood members to metal framing and substrates through drilled holes, providing the winged anchor is not visible in the finished work.
- D. All anchors and fasteners shall be stainless steel, galvanized, or specially treated to prevent corrosion as approved by the Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install wood nailers, backing, and blocking where indicated and where required for attachment and anchorage of other work.
- B. Coordinate location of wood members with other work involved. Provide wood nailers to be embedded in concrete for installation in formwork at the proper time.
- C. Attach wood members to substrates as required to support applied loading. Countersink bolt heads and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION 06 10 00

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SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Laminated Plastic Work
- B. Finish Cabinet Hardware
- C. Wood Backing and Blocking

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Custom cabinetwork will be measured for payment by the lump-sum method, acceptably furnished and installed.
- B. Payment: Custom cabinetwork will be paid for at the indicated Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCES

- A. American Plywood Association (APA):
 - 1. U.S. Product Standard PS 1 for Construction and Industrial Plywood
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
- C. American Wood Preservers Association (AWPA):
 - 1. AWPA C20 Structural Lumber, Fire-Retardant Pressure Treatment
 - 2. AWPA C27 Plywood, Fire-Retardant Pressure Treatment
- D. National Electrical Manufacturer's Association (NEMA):
 - 1. NEMA LD 3 High-Pressure Decorative Laminates
 - 2. NEMA LD 3.1 Performance, Application, Fabrication, and Installation of High-Pressure Decorative Laminates
- E. West Coast Lumber Inspection Bureau (WCLB):
 - 1. WCLB No. 17 Standard Grading Rules

F. Woodwork Institute (WI):

1. WI Manual of Millwork

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings: Submit fully detailed Shop Drawings of the cabinetwork, including plastic-laminate work and countertop edging. Shop Drawings shall be prepared in accordance with WI Manual of Millwork, Section 1, "Millwork Shop Drawings". Shop Drawings shall have a WI Certified Compliance Label on the first page of drawing set.

C. Product Data: Submit manufacturers' product data for plastic laminates, cabinet hardware, and any other manufactured or fabricated items indicated or specified.

D. Samples: Submit samples of plastic laminates and cabinet finish hardware.

E. Certificates: Submit WI Certified Compliance Certificate indicating that cabinetwork and its installation meets grade specified.

1.05 QUALITY ASSURANCE

A. Cabinetwork, as indicated, shall be manufactured or fabricated in accordance with the standard details and specifications of WI Manual of Millwork, as hereinafter specified.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery, storage, and handling of cabinets and related items shall be in accordance with applicable requirements WI Manual of Millwork, Section 1 - General Information.

PART 2 - PRODUCTS

2.01 WOOD BACKING AND BLOCKING

A. Wood backing and blocking shall be "Construction" or "No. 1" grade Douglas fir as defined in WCLB No. 17, of size and dimensions indicated or required. Moisture content shall not exceed 19 percent at time of installation.

1. Fire Retardant Treatment: Wood backing and blocking shall be pressure-impregnated with an AWPAC20 fire-retardant chemical suitable for the purpose. Each treated member shall be stamped with the AWPAC20 approved trademark and, in addition, the Classification Marking of the Underwriters' Laboratories, Inc. for Fire Hazard Classification shall be affixed to the back of each member. Wood blocking members shall be pre-cut to size and shape before being treated to preclude the need for field cutting and thus exposing untreated surfaces at cut ends. Any members which must still be cut in the field shall be dipped, after cutting, in the same fire-retardant chemical that was used in the pressure treating process.

- B. Plywood shall be Group 1 Species meeting requirements of PS 1, of sizes and thicknesses indicated or required. Each panel shall carry the APA grade trademark. Plywood shall be Exterior Grade or manufactured with Exterior Glue, with B-B, B-C or C-C (plugged) faces.
1. Fire-Retardant Treatment: Plywood shall be fire-retardant treated in accordance with AWPA C27 to have a flame spread rating of less than 25 when tested in accordance with ASTM E84. Comply also with applicable requirements specified above for wood backing and blocking.
- C. Anchors and Fasteners:
1. Wood and plywood backing and blocking shall be secured to metal framing with screws or bolts manufactured for the purpose of type and size required for the installation.
 2. Toggle bolts or screws may be employed to secure wood members to metal framing and substrates through drilled holes, providing the winged anchor is not visible in the finished work.
 3. All anchors and fasteners shall be stainless steel, galvanized, or specially treated to prevent corrosion.

2.02 CABINET MATERIALS

- A. Requirements: Unless specified otherwise herein, cabinetwork materials shall conform with the "Premium" Grade requirements of WI Manual of Millwork. All cabinetwork, including shelves and insides of drawers, shall be manufactured with plastic-laminate surfacing. Provide all materials required to complete the work whether herein specified or not, including finish cabinet hardware, specialty items, and accessories. Cabinetry shall accommodate equipment, fixtures, and devices to be provided under other Sections of these Specifications as indicated.
- B. Laminated Plastic Work:
1. Surfacing: Plastic-laminate surfacing material, exposed faces and edges, shall be a high-pressure decorative plastic laminate, conforming with NEMA LD 3. Plastic laminate material shall be solid color throughout the thickness of the material, so that when chipped or nicked, there will be no color variation from the surface color. Surface texture and color shall be as selected and approved by the Engineer from manufacturer's standards.
 2. Core: The core shall be plywood or medium density fiberboard (MDF). Plywood shall be an approved close-grained hardwood-faced plywood, not less than 5-ply and graded not less than B-B, with both sides sanded. Core shall have no added formaldehyde.
 3. Backing Sheet: Backing sheet shall be 0.020 inch standard (balancing) sheet plastic laminate. All laminated plastic work shall be fabricated with backing sheet.
 4. Adhesive: Type I waterproof glue manufactured for veneering plastic laminate to core material.

5. Fasteners and Accessories: Provide the required anchors, plates, clips, screws, and accessories for a concealed fastening system and as required for a complete and finished installation.

C. Finish Cabinet Hardware:

1. Requirements:
 - a. Provide finish hardware for cabinets as required to complete the Work. Hardware shall be as selected and approved by the Engineer from manufacturers' standards. Cabinet hardware shall conform with the Engineer's control samples.
 - b. Furnish all items of finish hardware required to equip the cabinets complete, whether specified herein or not.
 - c. Items of hardware not definitely specified herein but necessary for completion of the Work shall be provided at no additional cost to the District. Such items shall be of type and quality suitable for the service required and comparable to adjacent hardware in style and finish.
 - d. Each cabinet door shall be provided with appropriate hinges, pull, magnetic catches, elbow catches, and stops. Hinges shall be, at minimum, five-knuckle commercial hinges. Each cabinet drawer shall be provided with pull and drawer slides. Include key-operated locks for all cabinet doors and drawers.
2. Finish: The finish of all hardware shall be US32D, satin stainless, or US26D, satin chrome.
3. Drawer Slides: Drawers shall be fitted with full-extension drawer slides, rated for 100-lb. load capacity minimum.
4. Shelf Standards and Supports: Provide shelf standards and supports of types and sizes indicated or required, conforming the District requirements and with the Engineer's control samples.
5. Door and Drawer Pulls: Provide flush cabinet door and drawer pulls (flush with cabinet face) with finger lip/grip, conforming to the Engineer's control samples.

2.03 FABRICATION

- A. Work Quality: The quality of work shall be "Premium" grade flush overlay design in accordance with the requirements for Casework of WI Manual of Millwork. Cabinetmakers shall be skilled and experienced, and shall work under competent foremen in the shop and in the field.
- B. Laminated Plastic Work: Comply with applicable requirements of NEMA LD 3.1. Plastic laminate shall be applied to cores with approved waterproof adhesive. Edge laminates shall be applied first. All laminated plastic work shall have backing sheet as herein before specified.
- C. Assembly: Cabinetwork shall be assembled as fully as possible in the shop. When field assembly is necessary, the various units shall be accurately prefitted at the shop before shipment.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation of cabinetwork shall be as indicated and in accordance with the applicable requirements of WI Manual of Millwork for the specified grade. Work quality shall conform to "Premium" Grade requirements, as applicable.
- B. Cabinetwork shall be securely anchored and installed as indicated, plumb and level. Use leveling legs or shims where required to level cabinets. Finished work shall be satisfactory in every respect. Provide cut-outs for sinks and equipment, as indicated.
- C. Sufficient blocking and backing shall be provided as required to securely anchor all casework and cabinets.
- D. Finish hardware shall be installed accurately and securely without marking or defacing hardware or finish work. Test to assure correct alignment and operation. Items of finish hardware shall be fastened at all points where fasteners are indicated or required. Leave all hardware in good working order. Adjust, lubricate, clean, and polish.

END OF SECTION 06 41 00

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5.7 Division 7

Thermal and Moisture Protection

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SECTION 07 01 08

ROOF REPLACEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Modified Bitumen Roofing
- B. Copper Sheet Roofing
- C. Roof Deck Insulation

1.02 RELATED SECTIONS

- A. Coordinate the work of this Section with the work of other Sections specifying remedial work, corrective measures, and restoration work, including Section 02 41 19 - Selective Structure Demolition, and the other Sections of Division 7 - Thermal and Moisture Protection as applicable to the work.

1.03 DESCRIPTIONS

- A. The Work includes all required related metal flashings, roof drains, metal gutters and downspouts as indicated.
- B. The station or building involved in this work will be in continuous operation during the construction period. This will require that the Contractor plan the Work carefully to work around unavoidable obstacles in the prosecution of the Work. It will require further that the Contractor complete some new construction facilities required in the renovation work before proceeding with the re-roofing work.
- C. Provide such additional temporary facilities as may be required to facilitate continuous, unobstructed station or building operation during transitional construction work.

1.04 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for re-roofing will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for re-roofing indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for re-roofing, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for reroofing, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement
 - a. Reroofing, including removal of existing roofing, restoration of existing roof deck, new roof deck insulation, and new roofing, will be measured for payment by the

square foot, as indicated in the Bid Schedule of the Bid Form, acceptably furnished and installed.

- b. Substrate preparation, installation accessories, flashings, related metalwork, protection of non-roofed areas from moisture, and protection of completed surfaces will not be measured separately for payment, but will be considered included with the measurement specified above.

- 2. Payment: Reroofing, will be paid for at the Contract Unit Price for the computed quantities as determined by the measurement method specified in Article 1.04.C.1.

1.05 REFERENCES

- A. Comply with the Reference Standards specified in the other Sections of Division 7 as applicable to the re-roofing work.

1.06 REGULATORY REQUIREMENTS

- A. In addition to the foregoing specified referenced standards, the regulatory requirements which govern the work of this Section include the following governing code:
 - 1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Appendix Chapter 15, "Reroofing," and Chapter 34, "Existing Structures."

1.07 SUBMITTALS

- A. Provide submittals in accordance with the requirements of the other Division 7 Sections as applicable to the reroofing work, for the Engineer's review.

1.08 QUALITY ASSURANCE

- A. Reroofing work shall conform with the installation instructions and recommendations of the manufacturer of the roofing materials to be provided for this work.
- B. Quality assurance for the reroofing work shall conform with the quality assurance requirements of the other Division 7 Sections applicable to the work.

1.09 GUARANTY

- A. Provide Contractor's and manufacturer's guaranty as specified in the Division 7 Sections applicable to the work.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. Requirements: Provide all materials, equipment, tools, appurtenances, facilities, and services required for performing and completing reroofing work as indicated.

- B. Roofing Materials: Roofing materials shall conform with the applicable Division 7 Sections for the type of roofing indicated, as follows:
1. Roof Deck Insulation: Materials shall conform with the requirements of Section 07 22 00 - Roof and Deck Insulation.
 2. Modified Bitumen Roofing: Materials shall conform with the requirements of Section 07 52 16 - Modified Bitumen Roofing.
 3. Copper Sheet Roofing: Materials shall conform with the requirements of Section 07 61 00 - Sheet Metal Roofing.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. After removal of existing roofing, examine all roof deck surfaces for damaged and defective decking. Damaged or defective decking shall be repaired or replaced as required to provide substantial substrate surfaces conducive to the installation of new roof deck insulation and roofing. Substrate surfaces shall be clean and dry before beginning reroofing work.

3.02 ROOF DECK INSULATION

- A. Where indicated or required, install roof deck insulation over prepared and clean substrate surfaces in accordance with the requirements of Section 07 22 00, Roof and Deck Insulation.

3.03 INSTALLATION OF NEW ROOFING

- A. New roofing shall be installed in accordance with the requirements of the Division 7 Roofing Sections applicable to the work of this Section.
- B. All work shall be performed and completed as required to obtain the required guaranty.

END OF SECTION 07 01 08

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SECTION 07 12 16

BUILT-UP COAL TAR WATERPROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Concrete Primer
- B. Coal Tar Waterproofing Bitumen
- C. Coal Tar Saturated Felt
- D. Cotton Fabric
- E. Glass Fabric
- F. Flashing Cement
- G. Protective Sheathing Board
- H. Protective Paper

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for built-up coal tar membrane waterproofing will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for built-up coal tar membrane waterproofing indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for built-up coal tar membrane waterproofing, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 – Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for built-up coal tar membrane waterproofing, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Built-up coal tar membrane waterproofing will be measured for payment by the square yard (square) or square foot complete in place.
 - b. No deductions will be made for penetration less than one square yard in area.
 - c. Adhesives, fasteners, expansion joints, protection board and paper, and accessories will not be measured separately for payment; such items will be considered incidental to the bituminous membrane waterproofing work and included in the measurement specified above.

2. Payment: Built-up coal tar membrane waterproofing will be paid for at the Contract unit price for the computed quantities as determined by the measurement method specified in Article 1.02.C.1.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C208 Specification for Cellulosic Fiber Insulating Board
2. ASTM C981 Guide for Design of Built-Up Bituminous Membrane Waterproofing Systems for Building Decks
3. ASTM D43 Specification for Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing
4. ASTM D173 Specification for Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
5. ASTM D227 Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
6. ASTM D450 Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing
7. ASTM D1668 Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
8. ASTM D4022 Specification for Coal Tar Roof Cement

B. Federal Specifications (FS):

1. UU-B-790 Building Paper, Vegetable Fiber; (Kraft, Waterproofed, Water Repellent and Fire Resistant)

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit product data and detailed installation instructions for both vertical and horizontal applications.
- C. Manufacturer's Certification: At completion of the installation, submit written certification, signed by the manufacturer or its authorized representative, that the materials used in the work were in accordance with these Specifications, and that they were installed in accordance with the material manufacturer's installation instructions and recommendations.

1.05 QUALITY ASSURANCE

- A. Membrane waterproofing system shall be installed by an applicator/installer skilled and experienced in the type of work involved. Applicator shall be licensed and approved by the manufacturer who furnishes the materials.
- B. The Contractor shall make necessary arrangements with the manufacturer of the materials to be installed to provide on-site consultation and inspection service to assure the correct installation of the membrane waterproofing.
- C. The manufacturer's representative shall be present at the time any phase of the work is performed. Membrane waterproofing shall be applied only over substrate surfaces previously approved by the manufacturer's representative.

1.06 GUARANTY

- A. In addition to the guaranty requirements specified in General Conditions Article GC4.9, membrane waterproofing work shall be guaranteed against leakage, defective materials, and defective installation of the completed waterproofing work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, excavation and backfill, at no additional cost to the District.
- B. Said guaranty shall be in effect for a period of five years from the date of the Certificate of Substantial Completion issued by the District. The guaranty shall be signed by the waterproofing applicator or installer and countersigned by the Contractor, and shall be submitted to the Engineer as specified in Section 01 77 00 - Closeout Procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete Primer: ASTM D43, creosote primer.
- B. Coal-Tar Waterproofing Bitumen: ASTM D450, Type II, membrane waterproofing type for hot application.
- C. Coal-Tar Saturated Felt: ASTM D227, nominal 15-lb. weight per 108 sq. ft. coal-tar saturated felt.
- D. Cotton Fabric: ASTM D173, bituminous-resin saturated cotton fabric; for use at corners and other sharp bends, and for flashing of penetrations.
- E. Glass Fabric: ASTM D1668, Type II, woven glass fabric treated with bituminous resin; for bridging of cracks and for the glass-fabric reinforcing ply.
- F. Flashing Cement: ASTM D4022, coal-tar flashing cement of troweling consistency.
- G. Protective Sheathing Board: ASTM C208, vegetable fiber structural insulating board, or other sheathing board acceptable to the Engineer, 1/2 inch thick. For protection of wall waterproofing (vertical surfaces) from backfill damage.

- H. Protective Paper: Fed. Spec. UU-B-790, reinforced duplex laminated kraft paper, sealed with heavy-duty cloth masking tape or duct tape. For protection of slab membrane waterproofing (horizontal surfaces) from subsequent construction operations and traffic and from concrete protection slab as applicable.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspection of Substrates: Before starting the installation of any waterproofing work, there shall be a preconstruction walk through the areas to receive the waterproofing. Present shall be the Engineer, the Contractor, the installer, and a manufacturer's representative. Together examine all surfaces on which the waterproofing and flashings are to be applied. Examination includes review of transition conditions to ensure a watertight installation.
- B. Verify that substrate surfaces are clean and dry, and that concrete is properly aged.
- C. Verify that substrate and backing surfaces are smooth and rigid where membrane turns up.

3.02 APPLICATION

- A. Apply concrete primer to substrate surfaces at rate recommended by the waterproofing materials manufacturer.
- B. Membrane waterproofing for vertical and horizontal surfaces shall be applied in accordance with the latest specifications and installation instructions for membrane waterproofing of the manufacturer who furnishes the materials. One ply of the 4-ply system shall be the glass fabric reinforcing sheet.
- C. Comply with the applicable requirements of ASTM C981.
- D. Reinforce membrane at inside and outside corners and edges and around penetrations and projections in the substrate. Clamp membrane properly into floor drains.

3.03 FIELD QUALITY CONTROL

- A. Verify that kettle temperature of bituminous materials for hot application meets the waterproofing materials manufacturer's recommendations.
- B. Verify that installed membrane is free from wrinkles, blisters, exposed laps, fishmouths, and exposed surfaces. Damaged or defective membrane shall be corrected before covering or concealing the membrane with subsequent construction and finishes.
- C. If water test of horizontal surfaces is required by the Contract Specifications, conduct such test by applying a flood coat of water along the high areas so that water at least 1/4-inch deep flows over the areas. Perform test under the observation of the Engineer. Should a leak or low spot appear, repair the area and retest as specified above until all work is watertight and acceptable.
- D. Clean adjacent surfaces of spillage and splatterings of bituminous materials.

END OF SECTION 07 12 16

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SECTION 07 13 19

MODIFIED BITUMINOUS SHEET WATERPROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Self-adhesive, modified bituminous membrane
- B. Concrete and masonry primer
- C. Flashing cement
- D. Protection board
- E. Temporary protection board for horizontal surfaces

1.02 RELATED SECTIONS

- A. Precast concrete edge slabs at station platform and dielectric insulation for connecting dowels are specified in Section 03 40 00 - Precast Concrete.
- B. Sealant for dielectric insulation is specified in Section 07 90 00 - Joint Protection.

1.03 MEASUREMENT AND PROCEDURES

- A. General: Measurement and payment for modified bituminous sheet waterproofing will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for modified bituminous sheet waterproofing indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for modified bituminous sheet waterproofing, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for modified bituminous sheet waterproofing, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement
 - a. Modified bituminous sheet waterproofing will be measured for payment by the square yard (square) or square foot complete in place.
 - b. Adhesives, fasteners, protection board, and accessories will not be measured separately for payment; such items will be considered incidental to the modified bituminous sheet waterproofing work and included in the measurement specified above.

2. Payment: Modified bituminous sheet waterproofing will be paid for at the Contract unit price for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C208 Specification for Cellulosic Fiber Insulating Board
2. ASTM D41 Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
3. ASTM D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies
4. ASTM D257 Test Methods for DC Resistance or Conductance of Insulating Materials
5. ASTM D4586 Specification for Asphalt Roof Cement, Asbestos-Free

1.05 DESCRIPTION

A. Modified bituminous sheet waterproofing shall be a single-ply, self-adhering, rubberized asphaltic sheet membrane waterproofing system for vertical and horizontal surfaces as herein specified.

1. Membrane waterproofing under station platform slabs and for concourse slabs, where indicated, shall be the modified bituminous sheet waterproofing specified herein only.

B. The work of this Section includes dielectric insulation (membrane waterproofing) of precast concrete edge slabs at the station platform floor slab, as indicated.

1.06 SUBMITALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 -Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Product Data: Submit product data and detailed installation instructions for both vertical and horizontal applications

C. Manufacturer's Certification: At completion of the installation, submit written certification, signed by the manufacturer or its authorized representative, that the materials used in the work were in accordance with these Specifications, and that they were installed in accordance with the material manufacturer's installation instructions and recommendations.

D. Certified Test Report: Submit evidence of compliance with electrical resistance requirements for applications providing dielectric insulation. Include a certified copy of test results. Provide such

test results as a part of the record documents submittal specified in Section 01 78 39 - Project Record Documents.

1.07 QUALITY ASSURANCE

- A. Membrane waterproofing system shall be installed by an applicator/installer skilled and experienced in the type of work involved. Applicator shall be licensed and approved by the manufacturer who furnishes the materials.
- B. The Contractor shall make necessary arrangements with the manufacturer of the materials to be installed to provide on-site consultation and inspection service at no additional cost to the District, to assure the correct installation of the membrane waterproofing.
- C. The manufacturer's representative shall be present at the time any phase of the work is performed. Membrane waterproofing shall be applied only over substrate surfaces previously approved by the manufacturer's representative.

1.08 GUARANTY

- A. In addition to the guaranty requirements specified in General Conditions Article GC4.9, membrane waterproofing work shall be guaranteed against leakage, defective materials, and defective installation of the completed waterproofing work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, at no additional cost to the District.
- B. Said guaranty shall be in effect for a period of five years from the date of the Certificate of Substantial Completion issued by the District. The guaranty shall be signed by the waterproofing applicator or installer and countersigned by the Contractor, and shall be submitted to the District as specified in Section 01 77 00 - Closeout Procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Waterproofing Membrane: Pliable, self-adhesive membrane composed of high-strength polyethylene, factory-coated on one side with a layer of rubberized asphalt in minimum uniform thickness of 0.060 inch. Membrane shall also comply with the following electrical properties:

Property	Test Method	Typical Value
Volume Resistivity, 90 V - 60 sec.	ASTM D257	1.37 x 10 ¹⁴ Ω cm, average of 5 results
Dielectric Breakdown	ASTM D149	500 volts per mil
Insulation Resistance	ASTM D257	2.6 x 10 ⁶ megohm

- B. Concrete and Masonry Primer: Asphaltic primer as recommended by the membrane waterproofing materials' manufacturer and conforming generally to ASTM D41.
- C. Flashing Cement: Asphaltic adhesive or mastic as recommended by the membrane waterproofing materials' manufacturer and conforming generally to ASTM D4586 as appropriate.

- D. Protection Board for Vertical Surfaces: Rigid asphaltic-composition board as recommended by the membrane waterproofing materials manufacturer, nominal 1/4-inch thick, or structural insulating board conforming to ASTM C208, applied and held in place with adhesive or sealant recommended by the membrane waterproofing materials' manufacturer.
- E. Temporary Protection Board for Horizontal Surfaces: Rigid asphalt-composition, traffic-bearing board, nominal 1/4-inch thick, installed with adhesive recommended by the membrane waterproofing materials' manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION AND CLEANING OF SUBSTRATE

- A. Verify that substrate surfaces are clean and dry, and that concrete is properly aged.
- B. Verify that substrate and backing surfaces are smooth and rigid where membrane turns up.
- C. Vacuum-clean substrate surfaces as required to remove dirt and dust.

3.02 APPLICATION

- A. Apply concrete primer to substrate surfaces at rate recommended by the waterproofing materials manufacturer.
- B. Membrane waterproofing for vertical and horizontal surfaces shall be applied in accordance with the manufacturer's latest specifications and installation instructions for membrane waterproofing.
- C. Reinforce membrane at inside and outside corners and edges and around penetrations and projections in the substrate. Clamp membrane properly into floor drains.
- D. After the membrane waterproofing application on vertical surfaces has been inspected and accepted by the Engineer, install protection board in accordance with the manufacturer's installation instructions and recommendations for protection of the membrane waterproofing from backfilling operations and backfill material. Install temporary protection board with adhesive on horizontal surfaces in accordance with the manufacturer's installation instructions and recommendations for protection from subsequent construction operations and traffic. Protection board damaged during subsequent construction operations and activities shall be immediately repaired or replaced. Remove temporary protection board just before placing concrete topping slabs.

3.03 DIELECTRIC INSULATION

- A. In addition to the requirements for membrane waterproofing of horizontal surfaces specified herein, dielectric insulation shall meet the following requirements:
 - 1. Stop membrane waterproofing 1/2 inch below top of finished topping slab to allow for joint sealant application.
 - 2. Seal membrane waterproofing completely around dowel sleeves.

3.04 FIELD QUALITY CONTROL

- A. Verify that installed membrane is free from wrinkles, blisters, and exposed surfaces. Damaged or defective membrane shall be corrected.
- B. Verify that waterproof membrane is free from defects or damage before covering or concealing the membrane with subsequent construction and finishes.
- C. If water test of horizontal surfaces is required by the Contract Specifications, conduct such test by applying a flood coat of water along the high areas so that water at least 1/4 inch deep flows over the areas. Perform test under the observance of the Engineer. Should a leak or low spot appear, repair the area and retest as specified above until all work is watertight and acceptable.
- D. Clean adjacent surfaces of spillage and splatterings of bituminous materials.

END OF SECTION 07 13 19

BART Facilities Standards (BFS)

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SECTION 07 13 29

BUTYL RUBBER MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Butyl rubber sheet membrane
- B. Adhesive
- C. Vulcanizing cement
- D. Butyl gum tape
- E. Membrane protection board
- F. Anti-bonding paper
- G. Rubberized asphalt

1.02 RELATED SECTIONS

- A. Finishing and curing of concrete bridge decks are specified in Section 03 35 00 - Concrete Finishing

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for butyl rubber membrane waterproofing will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for butyl rubber membrane waterproofing indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for butyl rubber membrane waterproofing, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for butyl rubber membrane waterproofing, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement
 - a. Butyl rubber membrane waterproofing will be measured for payment by the square yard (square) or square foot complete in place.
 - b. Adhesives, tape, expansion joints, protection board, and accessories will not be measured separately for payment; such items will be considered incidental to the membrane waterproofing work and included in the measurement specified above.
 - 2. Payment: Butyl rubber membrane waterproofing will be paid for at the Contract unit price for the computed quantities as determined by the measurement method specified in Article 1.03.C.1

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M173 Specification for Concrete Joint-Sealer, Hot-Poured Elastic Type
- B. American Railway Engineering and Maintenance of Way Association (AREMA):
 - 1. Manual for Railway Engineering (herein referred to as the "AREMA Manual"), Volume II, Chapter 29, "Waterproofing"
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM D517 Specification for Asphalt Plank
 - 2. ASTM D1190 Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
- D. Federal Specifications (FS):
 - 1. SS-S-1401 Sealants, Joint, Non-Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Asphalt Concrete Pavements

1.05 DESCRIPTION

- A. Membrane waterproofing shall be a single-ply, butyl-rubber sheet membrane waterproofing system for ballasted concrete bridge decks as specified in the AREMA Manual, Chapter 29, Part 2, Membrane Waterproofing.

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit product data and detailed installation instructions for both vertical and horizontal applications.
- C. Manufacturer's Certification: At completion of the installation, submit written certification, signed by the manufacturer or its authorized representative, that the materials used in the waterproofing work were in accordance with these Specifications, and that they were installed in accordance with the material manufacturer's installation instructions and recommendations.

1.07 QUALITY ASSURANCE

- A. Membrane waterproofing system shall be installed by an applicator/installer skilled and experienced in the type of work involved. Applicator shall be approved by the manufacturer who furnishes the materials.

- B. The Contractor shall make necessary arrangements with the manufacturer of the materials to be installed to provide on-site consultation and inspection service to assure the correct installation of the membrane waterproofing.
- C. The manufacturer's representative shall be present at the time any phase of the work is performed. Membrane waterproofing shall be applied only over substrate surfaces previously approved by the manufacturer's representative.

1.08 GUARANTY

- A. In addition to the guaranty requirements specified in General Conditions Article GC4.9, membrane waterproofing work shall be guaranteed against leakage, defective materials and defective installation of the completed waterproofing work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, at no additional cost to the District.
- B. Said guaranty shall be in effect for a period of five years from the date of Certificate of Completion or Substantial Completion issued by the District. The guaranty shall be signed by the waterproofing applicator or installer and countersigned by the Contractor, and shall be submitted to the Engineer as specified in Section 01 77 00 - Closeout Procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Waterproofing Membrane: Pliable, butyl-rubber sheet material in minimum uniform thickness of 0.060 inch, conforming to the requirements of the AREMA Manual, Chapter 29, Part 2, Article 2.3.5.
- B. Adhesive: As specified in the AREMA Manual, Chapter 29, Part 2, Article 2.3.6.
- C. Vulcanizing Cement: As specified in the AREMA Manual, Chapter 29, Part 2, Article 2.3.7, for butyl-rubber membrane splices.
- D. Butyl Gum Tape: As specified in the AREMA Manual, Chapter 29, Part 2, Article 2.3.8, for tongue-and-groove splices and lap splices.
- E. Membrane Protection Board: Asphalt plank conforming to ASTM D517, plain type, applied in minimum thickness of one inch using two layers with joints staggered; or asphaltic panels conforming to the AREMA Manual, Chapter 29, Part 2, Article 2.4.7, applied in minimum thickness of 3/4 inch using two layers with joints staggered.
- F. Anti-bonding paper shall be a tough, impervious paper with weight of not less than 5 pounds per 100 square feet.
- G. Rubberized Asphalt shall conform to AASHTO M173, ASTM D1190 or Fed. Spec. SS-S-1401.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are clean and dry, and that concrete is properly aged.
- B. Verify that substrate and backing surfaces are smooth and rigid where membrane turns down at edges and vertical surfaces, and up at curbs and other vertical barriers.

3.02 APPLICATION

- A. Comply with applicable requirements of the AREMA Manual, Chapter 29, Part 2, Article 2.9.
- B. Membrane waterproofing shall be applied in accordance with the manufacturer's installation instructions for membrane waterproofing of ballasted bridge decks. Adhesive shall be applied to the entire surface to be waterproofed.
- C. All splices and seams of the membrane material shall be tongue and groove butyl membrane splices in accordance with the AREMA Manual, Chapter 29, Part 2, Figure 2.
- D. Reinforce membrane at inside and outside corners and edges and around penetrations and projections in the substrate.
- E. After the membrane waterproofing application has been inspected and accepted by the Engineer, install protection board with adhesive in accordance with the manufacturer's installation instructions and recommendations, for protection from subsequent construction operations and ballasted track installation. Protection board damaged during subsequent construction operations and activities shall be properly repaired or replaced immediately.

3.03 FIELD QUALITY CONTROL

- A. Verify that installed membrane is free from wrinkles, buckles, blisters (trapped air) and other damage. Damaged or defective membrane shall be corrected.
- B. Verify that waterproof membrane is free from defects or damage before covering or concealing the membrane with protection board.
- C. Clean adjacent surfaces of spillage and splatterings of adhesive materials.

END OF SECTION 07 13 29

SECTION 07 17 00

BENTONITE WATERPROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Bentonite panels
- B. Bentonite tubes
- C. Bentonite gel
- D. Bulk bentonite
- E. Protective cover material
- F. Protection board

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for bentonite waterproofing will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for bentonite waterproofing indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for bentonite waterproofing, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for bentonite waterproofing, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement
 - a. Bentonite waterproofing will be measured for payment by the square yard or square foot complete in place. Double-layer installation will be measured separately from single-layer installation; however, overlaps in a single layer will not be measured.
 - b. Tubes, gel, bulk bentonite, protective cover sheet, protection board, fasteners, and miscellaneous accessories will not be measured separately for payment; such items will be considered incidental to the bentonite waterproofing work and included in the measurement specified above.
 - 2. Payment: Bentonite waterproofing will be paid for at the Contract unit price for the computed quantities as determined by the measurement methods specified in Article 1.02.C.1.

1.03 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, Samples, for submittal requirements and procedures.
- B. Product Data: Submit manufacturer's product data demonstrating compliance with specification requirements. Submit manufacturer's installation instructions and details, separately for each condition of bentonite waterproofing installation.

1.04 QUALITY ASSURANCE

- A. Bentonite waterproofing system shall be installed by an applicator/installer skilled and experienced in the type of work involved. Applicator shall be licensed and approved by the manufacturer who furnishes the materials.
- B. The Contractor shall make necessary arrangements with the manufacturer of the bentonite materials to be installed to provide on-site consultation and inspection service to assure the correct installation of the bentonite waterproofing.
- C. The manufacturer's representative shall be present at the time any phase of the work is performed. Bentonite waterproofing shall be installed only over substrate surfaces previously approved by the manufacturer's representative.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store bentonite materials in a dry location, off the ground, and protected from physical damage and moisture.

1.06 ENVIRONMENTAL CONDITIONS

- A. Do not install bentonite products in standing or running water conditions, or during rain or damp weather.

1.07 GUARANTY

- A. In addition to the guaranty requirements specified in General Conditions Article GC4.9, bentonite waterproofing work shall be guaranteed against leakage, defective materials, and defective installation of the completed waterproofing work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, at no additional cost to the District.
- B. Said guaranty shall be in effect for a period of five years from the date of the Certificate of Substantial Completion issued by the District. The guaranty shall be signed by the bentonite waterproofing applicator or installer and countersigned by the Contractor, and shall be submitted to the Engineer as specified in Section 01 77 00 - Closeout Procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Requirements: Bentonite waterproofing system shall include bentonite panels, bentonite in tube, gel, or mastic form, and dry granular bentonite, all products of a single manufacturer.

- B. Bentonite: Specially selected natural Wyoming type granular bentonite, containing a minimum 90 percent montmorillonite, graded so that 90 percent will pass a 20 mesh sieve and less than 10 percent will pass a 200 mesh sieve.
- C. Panels: Minimum one pound granular bentonite per square foot, packed into flutes of corrugated biodegradable kraft board or between layers of porous polypropylene.
- D. Tubes: Granular bentonite in 2-inch diameter water soluble tubes.
- E. Gel: Trowelable grade of bentonite that has been hydrated to maximum gel strength.
- F. Bulk Bentonite: Dry granular bentonite packaged in 50-pound bags.
- G. Protective Cover Sheet: Minimum 4 mil thick polyethylene.
- H. Protection Board: As recommended by the bentonite products' manufacturer.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Protect bentonite from premature hydration at all times. Where bentonite is installed directly against earth or wood lagging, place a layer of protective cover sheet under the bentonite. Where backfill or concrete is not placed against bentonite immediately after the bentonite is installed, cover the bentonite with protective cover sheet until backfill is placed. As an alternative to the foregoing, bentonite panels that have been coated with a water-repellent resin on the exposed face may be used.
- B. When the presence of salt in the groundwater is indicated, use only bentonite that is certified by the manufacturer for use under salt water conditions without freshwater pre-hydration. Obtain groundwater samples and have them tested by the manufacturer if necessary to obtain this certification.
- C. Apply two or more layers of bentonite panels wherever the indicated hydrostatic head exceeds the manufacturer's rated depth for single-layer installation. Comply with the manufacturer's special requirements for installation at such depths. When installing double layers, do not overlap joints; butt panels together and stagger joints in the two layers a minimum of 12 inches.

3.02 INSTALLATION ON FREE-STANDING WALLS

- A. Preparation:
 - 1. Concrete surfaces shall be free of large voids and projections (such as mortar fins) extending more than 1/16 inch from the surface. Grind off such projections. Fill voids with cement mortar or bentonite gel.
 - 2. On concrete block masonry surfaces, apply a 1/2 inch thick parge coat of sand-cement and allow to cure three days before applying bentonite.

3. Do not commence installation until preparation is complete and has been inspected and approved by the manufacturer's representative.
- B. Attach panels with 3/4 inch or 1 inch masonry washer-head nails. Lap adjoining panels a minimum of 1-1/2 inches. Stagger vertical joints in succeeding courses.
- C. When cutting, trimming, and folding, follow manufacturer's instructions to prevent loss of bentonite granules.
- D. Cut panels to fit around pipes and penetrations. Trowel a fillet of gel around the penetration and a minimum of 2 inches up the penetration just prior to backfilling.
- E. Provide protection board when the backfill contains sharp stones (such as crushed rock) or any stones larger than 2 inches.
- F. Refer to Section 31 00 00 - Earthwork, and Article 3.01.A above regarding backfill requirements. Exercise care to avoid damage to bentonite waterproofing by backfilling operations.

3.03 INSTALLATION UNDER SLABS AND FOOTINGS

- A. Place a layer of protection sheet over the substrate to prevent premature hydration of bentonite, or use panels having a water-resistant coating.
- B. Overlap panels a minimum of 1-1/2 inches and nail into soil or staple together. Stagger joints in succeeding courses.
- C. Where slabs are poured in sections, necessitating the use of side forms with stakes, install panels to extend a minimum of 6 inches beyond the outside of the form. Drive the form stakes through the extended panels. When the stakes are removed, fill the holes with dry bentonite granules, and overlap the stake holes with the next panel. Do not allow polyethylene sheeting, where used, to extend between overlapped panels.
- D. Do not extend panels over pile caps or piles, except as specifically indicated.
- E. Comply with manufacturer's instructions for extension of panels up the outer sides of slabs and footings.

3.04 INSTALLATION AGAINST SIDES OF SUPPORTIVE EXCAVATION

- A. When bentonite panels are installed directly against the inside surface of soldier piles and lagging, diaphragm walls, or other support system to be left in place, prepare the surface by filling voids greater than 1/2 inch with cement mortar, or place a suitable geotextile over the entire surface.
- B. If water is present on the surface of the excavation support, place protective cover sheet over the surface or use panels having a water-resistant coating.
- C. Overlap panels a minimum of 1-1/2 inches and nail in place. Stagger joints in succeeding layers. Do not extend panels beyond finish grade.

3.05 FIELD QUALITY CONTROL

- A. Verify that bentonite waterproofing is free from defects or damage before backfilling or concealing the waterproofing with subsequent construction and finishes. Damaged or defective waterproofing shall be corrected.

END OF SECTION 07 17 00

BART Facilities Standards (BFS)

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SECTION 07 18 16

VEHICULAR TRAFFIC COATINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Liquid-applied elastomeric, vehicular traffic-bearing, waterproofing
- B. Flashings
- C. Traffic surface

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for vehicular traffic deck coating will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for vehicular traffic deck coating indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for vehicular traffic deck coating, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for vehicular traffic deck coating, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement
 - a. Vehicular traffic deck coating, will be measured for payment by the square foot or square yard, as indicated in the Bid Schedule of the Bid Form, acceptably furnished and installed.
 - b. Substrate preparation, installation accessories, and protection of completed surfaces will not be measured separately for payment, but will be considered included with the measurement specified above.
 - 2. Payment: Vehicular traffic deck coating, will be paid for at the Contract unit price for the computed quantities as determined by the measurement method specified in Article 1.02.C.1.

1.03 SYSTEM DESCRIPTION

- A. The traffic deck coating (traffic topping) system shall be a VOC-compliant, cold, liquid-applied polyurethane or aliphatic urethane, elastomeric, waterproof membrane with integral skid-resistant vehicular traffic-bearing wearing surface.
- B. The membrane may be single-component or multi-component, and shall consist of at least three coats (base, intermediate, and top coats), built up to a minimum overall dry-film thickness of 45 mils or the minimum thickness recommended by the manufacturer's installation instructions, whichever is greater. The finished installation shall be capable of bridging 1/16 inch new cracks

and floor movement, at a minimum, without failure. Membrane shall be recoatable and repairable.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C811 Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacing
2. ASTM C957 Specification for High-Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Integral Wearing Surface
3. ASTM D4263 Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method

B. International Concrete Repair Institute (ICRI):

1. ICRI 03732 Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, Samples, for submittal requirements and procedures.

B. Shop Drawings: Submit installation and flashing details for all roof deck penetrations, curbs, and parapets.

C. Product Data: Submit manufacturer's product data and installation specifications of the traffic deck coating system.

D. Samples: Submit sample 10-inch squares of the finished traffic deck coating installation, in manufacturer's standard color as selected by the Engineer. Color and texture proposed for the finished installation require approval of the Engineer before the work of this Section may proceed.

E. Manufacturer's Certification: At completion of the installation, submit written certification, signed by the manufacturer or its authorized representative, that the materials used in the work were in accordance with these Specifications, and that they were installed in accordance with the material manufacturer's installation instructions and recommendations.

1.06 QUALITY ASSURANCE

A. Vehicular traffic-bearing deck coating system shall be installed by an applicator/installer skilled and experienced in the type of work involved. Applicator/installer shall be licensed and approved by the manufacturer that furnishes the materials.

- B. The Contractor shall make necessary arrangements with the manufacturer of the materials to be installed to provide on-site consultation and inspection services to assure the correct installation of the traffic-bearing deck coating system.
- C. The manufacturer's representative shall be present at the time any phase of the work is started. Membrane waterproofing deck coating system shall be applied only over substrate surfaces previously approved by the manufacturer's representative.

1.07 GUARANTY

- A. Waterproof traffic-bearing deck coating work shall be guaranteed against defective materials and work quality and against leakage due to faulty or inferior materials, inadequate installation, and installation supervision, and inadequate protection of completed work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, at no additional cost to the District.
- B. In addition to the guaranty requirements specified in General Conditions Article GC4.9, said guaranty shall be in effect for a period of five years from the date of the Certificate of Substantial Completion issued by the District. The guaranty shall be signed by the deck coating system applicator or installer and countersigned by the Contractor, and shall be submitted to the Engineer as specified in Section 01 77 00 - Closeout Procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Deck Type and Manufacturer: The liquid-applied polyurethane or aliphatic urethane elastomeric, waterproof, traffic-bearing floor and base coating system and materials shall conform to applicable requirements of ASTM C957, and shall be the products of a manufacturer who specializes in and is regularly engaged in the manufacture of these materials. Latex type membrane coating systems will not be acceptable. Include the base coat, intermediate coats, and top coat, and all installation accessories and non-skid materials, all by the same manufacturer.
- B. Flashings: Flashings shall be an integral composition flashing material similar to and monolithic with the elastomeric membrane specified above.
- C. Color: Color of the traffic surface and base shall be as selected and approved by the Engineer from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION OF SUBSURFACES

- A. Inspection of Subsurfaces: Before starting the installation of any traffic-bearing deck coating work, examine all surfaces that the deck coating and base membrane and flashings are to be applied. Examination includes bond, moisture, and alkali testing of concrete as required or recommended by the manufacturer of the deck coating system components.
 - 1. Test concrete deck for moisture in accordance with ASTM D4263.

B. Cleaning and Preparation of Substrate Surfaces:

1. Substrate surfaces that the deck coating membrane, base, and flashings are to be applied shall be dry, clean of dirt and dust, paint, grease, and free of bond-breaking and curing compounds.
 - a. Concrete substrate surfaces shall be properly prepared and cleaned in accordance with ASTM C811 as recommended by the deck coating system manufacturer.
 - b. Where the manufacturer determines that the concrete substrate needs to have a "roughened" surface to provide mechanical key for better adhesion of the base coat, perform shotblasting or bead blasting in accordance with ICRI 03732.
2. Substrate surfaces shall also be free from roughness and defective surfaces that will prevent a level and plane installation. Fill all joints, cracks, or depressions in substrate surfaces with floor patch or underlayment material recommended by the manufacturer of the deck coating system components, as required. Substrate surfaces shall be level to within 1/8 inch in 8 feet when checked in any direction by an 8-foot straightedge, or sloped for drainage as indicated.

3.02 INSTALLATION

- A. The waterproof, composition, elastomeric traffic-bearing membrane coating system and related flashings shall be installed in accordance with the manufacturer's specifications, installation instructions, and recommendations, using only workers skilled and experienced in the installation of the type of work involved.
- B. The finished installation shall be uniform in color and texture.

3.03 FIELD QUALITY CONTROL

- A. Verify that the installed deck coating membrane is free from wrinkles, blisters, and exposed surfaces. Damaged or defective membrane shall be corrected.
- B. If water test of horizontal surfaces is required by the Contract Specifications, conduct such test by applying a flood coat of water along the high areas so that water at least 1/4 inch deep flows over the areas. Perform test under the observation of the Engineer. Should a leak or low spot appear, repair the area and retest as specified above until all work is watertight and acceptable.
- C. Clean adjacent surfaces of spillage and splatterings of deck coating materials, if any.

END OF SECTION 07 18 16

SECTION 07 21 11

BUILDING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes specifications for thermal insulation for roof attic spaces and exterior walls of station structures and other buildings as indicated.
- B. This Section also includes acoustical (sound-retardant) insulation for interior walls and partitions, furred spaces, and ceilings as indicated.

1.02 MEASUREMENT AND PAYMENT

- A. General: Building insulation will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C553 Specification for Mineral Fiber Blanket and Thermal Insulation for Commercial and Industrial Applications
 - 2. ASTM C665 Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 - 3. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Fire-Retardant Requirements: Insulation shall have a flame-spread rating of 25 or less and a smoke-developed contribution of 5 or less when tested in accordance with ASTM E84.
- B. Thermal Insulation: Fiberglass or mineral-fiber foil-faced standard building insulation with vapor barrier and flanges for fastening, meeting requirements of ASTM C553 or ASTM C665, as applicable, minimum thermal resistance, R value of 19 with minimum nominal installed thickness of 6 inches for attic spaces (underside of roof decks), and minimum thermal resistance, R value of 11 with minimum nominal installed thickness of 3 inches for exterior walls.
- C. Acoustical Insulation: Fiberglass or mineral-fiber foil-faced or unfaced sound-attenuation batts or blankets for tight friction fit between framing members, meeting requirements of ASTM C553 or ASTM C665, as applicable. Provide minimum 3-inch thick batts or blankets for furred spaces, stud walls, and spaces above suspended ceilings. Insulation shall provide a minimum sound transmission class (STC) assembly rating of 50 (45 if field tested) when installed in standard 3-5/8-inch steel-stud wall with single layers of 5/8-inch gypsum board both sides.

- D. Fasteners and Adhesives: Provide fastening or attaching devices, nails, staples, stick clips, and adhesives as required to securely fasten or hold insulation in place, as recommended by the manufacturer of the insulation used.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Insulation shall be installed in all locations as indicated. Insulation shall be installed in accordance with the manufacturer's installation instructions and recommendations, using fasteners and adhesives as required. In attic spaces and exterior walls, insulation shall be installed with the foil face facing the interior of the building.
- B. Insulation shall be installed to the underside of metal roofing in attic spaces with stick clips and adhesive as required to provide a blanket membrane without sags. If sagging occurs, provide No. 10 or No. 12 wire, tautly installed, to help hold insulation in place and to keep insulation from sagging.
- C. Batt or blanket type insulation shall be installed between studs and joists, fitted between (not over) plates, braces, blocking, or solid bridging, with no voids of insulation.
- D. Acoustical insulation shall be installed tightly between studs, joists, plates, braces, and blocking, with no voids of insulation. Provide adhesive, tape, or other appropriate fasteners where required to hold insulation rigidly in place. Openings and penetrations in acoustical walls and partitions shall be sealed airtight.
- E. Provide minimum 3-inch thick batt or blanket insulation in wall cavities containing plumbing and heating pipes. Include ceiling cavities within 12 inches of plumbing and heating pipes.
- F. Insulation shall be installed after piping and wiring have been installed, tested, inspected, and approved.

END OF SECTION 07 21 11

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roof insulation
- B. Adhesive
- C. Fasteners
- D. Roof tape
- E. Asphalt
- F. Bituminous plastic cement
- G. Wood stops, blocking, and insulation-containment members

1.02 MEASUREMENT AND PAYMENT:

- A. Roof deck insulation will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

- 1. ASTM C726 Specification for Mineral Fiber Roof Insulation Board
- 2. ASTM C728 Specification for Perlite Thermal Insulation Board
- 3. ASTM D312 Specification for Asphalt Used in Roofing
- 4. ASTM D2822 Specification for Asphalt Roof Cement
- 5. ASTM D3747 Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation
- 6. ASTM D4586 Specification for Asphalt Roof Cement, Asbestos-Free

B. Federal Specifications (FS):

- 1. TT-W-550 Wood Preservative, Chromated Copper Arsenate Mixture
- 2. TT-W-571 Wood Preservation: Treating Practices

C. Underwriters Laboratories (UL):

1. UL 580 Tests for Uplift Resistance of Roof Assemblies
2. UL 790 Tests for Fire Resistance of Roof Covering Materials

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit manufacturer's product data of the roof deck insulation proposed for this work.

1.05 QUALITY ASSURANCE

- A. Insulation and roofing shall meet Underwriters Laboratories requirements for Class A fire rating and Class I-90 wind uplift resistance in compliance with UL 790 and UL 580, respectively.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Roof Insulation: Roof deck insulation shall be of polyisocyanurate foam core laminated to glass reinforced mat facer. Furnish in thickness required to provide minimum thermal resistance, R value of 9, or as required and sufficient to span the flute of metal decking. Insulation shall be applied in at least two layers with staggered joints. Provide tapered roof insulation board where required for roof drainage. Tapered insulation can be of the same material as the deck insulation or a perlite-based material. Cover shall be perlite board conforming to the requirements of ASTM C728. Roof insulation material and insulation shall be compatible with the roofing system as recommended by the roofing materials manufacturer.
- B. Adhesive: ASTM D3747.
- C. Fasteners: Insulation board fasteners with appropriate stress-plate washers, manufactured specifically for securing insulation board to metal decking.
- D. Roof Tape: Manufactured specifically for welding of tape over insulation joints, 6 inches wide.
- E. Asphalt: ASTM D312, Type III.
- F. Bituminous Plastic Cement: ASTM D2822 or ASTM D4586.
- G. Wood Stops, Blocking, and Insulation-Containment Members: Pressure-treated "Construction" or "No.1" grade Douglas fir as specified in Section 06 10 00 - Rough Carpentry, treated with preservative in accordance with FS TT-W-550 for preservative material and FS TT-W-571 for pressure treating.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Coordinate roof insulation installation with the installation of roofing
- B. Surfaces that insulation is to be applied shall be smooth and dry, free from loose particles, and shall be swept clean.
- C. Install insulation board in accordance with the insulation manufacturer's installation instructions and recommendations. Apply boards with adjacent ends staggered not less than 24 inches.
- D. Install perimeter wood containment members and stops with mechanical fasteners as indicated or required.
- E. Mop boards into place using hot steep asphalt applied in ribbons on 6 inch centers; press firmly into place. Cut boards to fit neatly around vent pipes, curbs, vertical surfaces, and other deck projections.
- F. Where required for additional holding power for holding boards in place, provide mechanical fasteners of type specified and installation method recommended by the fastener manufacturer.
- G. Apply roof tape in hot asphalt over all joints of insulation board in accordance with the insulation and tape manufacturer's taped joint system specifications and recommendations. Apply roof tape over joints between adjacent insulation boards and between wood blocking or insulation stops and insulation boards. Broom roof tape into asphalt.
- H. Lay no more boards than will be covered with completed roofing on the same day. Do not leave installed boards exposed to weather. Provide protection of insulation from rain and moisture.
- I. Provide water cut-offs at exposed edges of insulation at end of day's work and whenever rain is imminent. Extend cut-offs 6 inches on roof deck, carry up and over roof insulation, and extend 6 inches on top of roofing. Remove before continuing installation of insulation.

END OF SECTION 07 22 00

BART Facilities Standards (BFS)

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SECTION 07 26 00

VAPOR RETARDERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Polyvinyl chloride membrane sheeting
- B. Adhesive
- C. Tape

1.02 RELATED SECTIONS

Aggregate drainage fill and sand cushion are specified in section 32 11 24 – Aggregate Drainage Layer.

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for vapor barrier will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for vapor barrier indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for vapor barrier, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.
- C. Unit Prices: If the Bid Schedule indicates a unit price for vapor barrier, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement
 - a. Vapor barrier will be measured for payment by the square yard or square foot complete in place.
 - b. Adhesives, tape, and accessories will not be measured separately for payment; such items will be considered incidental to the vapor barrier installation and included in the measurement specified above.
 - 2. Payment: Vapor barrier will be paid for at the Contract unit price for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM D1593 Specification for Nonrigid Vinyl Chloride Plastic Sheeting
 - 2. ASTM D3083 Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, Samples, for submittal requirements and procedures.
- B. Samples: Submit representative samples of the polyvinyl chloride vapor barrier material, adhesive, and tape.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Vapor Barrier Sheeting: Polyvinyl chloride plastic membrane sheeting, meeting requirements of ASTM D1593 or ASTM D3083, 10 mils thick.
- B. Adhesive: Synthetic rubber base cement, manufactured specifically for use with poly-vinyl chloride membrane material for cold application.
- C. Tape: Pressure-sensitive neoprene or vinyl-chloride rubber adhesive tape as recommended by the manufacturer of the vapor barrier material or a heavy-duty cloth masking tape, minimum 3" wide; for sealing of laps and joints in vapor barrier sheets.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Lay vapor barrier sheets directly over compacted aggregate drainage fill (between compacted aggregate drainage fill and sand cushion) without damaging the sheets. Repair punctures and tears in vapor barrier sheets occurring during subsequent operations. Vapor barrier shall be continuous between footings or foundation walls, without voids.
- B. Lap edges not less than 4 inches and ends not less than 6 inches, with all laps sealed continuously with adhesive and tape.
- C. Turn up membrane a minimum of 2 inches or to within 1/2 inch of top of slab at edges and secure to wall foundations or footings with specified adhesive and tape.
- D. Fit and seal vapor barrier tightly around pipes and conduits that penetrate the fill.

END OF SECTION 07 26 00

SECTION 07 52 16

MODIFIED BITUMEN ROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Base sheet
- B. Cap Sheet
- C. Base flashing
- D. Cold Application Adhesive
- E. Flashing cement
- F. Cants

1.02 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for modified bitumen roofing will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for modified bitumen roofing indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for modified bitumen roofing, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 – Price and Payment Procedures.
- C. Unit Price: If the Bid Schedule indicates a unit price for modified bitumen roofing, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement
 - a. Modified bitumen roofing, will be measured for payment by the square foot or square yard, as indicated in the Bid Schedule of the Bid Form, acceptably furnished and installed.
 - b. Substrate preparation, installation accessories, flashings, protection of non-roofed areas from moisture, and protection of completed surfaces will not be measured separately for payment, but will be considered included with the measurement specified above.
 - 2. Payment: Modified bitumen roofing, will be paid for at the Contract unit price for the computed quantities as determined by the measurement method specified in Article 1.02.C.1.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):

MODIFIED BITUMEN ROOFING

1. ASTM D 41 Asphalt Primer Used In Roofing, Dampproofing and Waterproofing
2. ASTM D 312 Specification for Asphalt Used in Roofing
3. ASTM D 2822 Specification for Asphalt Roof Cement
4. ASTM D 3019 Specification for Lap Cement used in Asphalt Roll Roofing
5. ASTM D 4586 Specification for Asphalt Roof Cement, Asbestos Free
6. ASTM D 5147 Standard Test Methods for Sampling and Testing Modified Bituminous Materials
7. ASTM D 6162 Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester & Glass Fiber Reinforcements
8. ASTM D 6163 Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

1.04 REGULATORY REQUIREMENT

- A. In addition to the reference standards, the regulatory requirements that govern the work of this Section include the following governing code:
- B. California Code of Regulations (CCR), Title 24, California Building Code, Chapter 15, "Roofs and Roof Structures."

1.05 ROOF SYSTEM DESCRIPTION

- A. Modified bitumen roofing membranes, base flashing, insulation, and flashing at metalwork and roof penetrations shall meet or exceed the requirements of a three-ply cold applied modified bitumen roofing system for which an approved single manufacturer can issue a 15-year guarantee.

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit manufacturer's specifications for materials and installation of the appropriate roofing system and related flashing, for review. Work shall not proceed until the manufacturer's specifications have been approved by the Engineer and returned to Contractor.
- C. Samples: Submit sample square 8-inch by 8-inch for base, intermediate, and cap felts, and base flashing.
- D. Shop Drawings: Within 20 calendar days of the effective date of the Notice to Proceed, submit the following for approval:
 1. Shop drawings showing setting plan for the insulation including tapered insulation, layout of felts and flashing details.

1.07 QUALITY ASSURANCE

A. Performance Requirements:

1. Roofing materials shall be furnished by a manufacturer specializing in the manufacture of roofing materials
2. Roofing work and related flashings shall be installed by a licensed contractor approved by the manufacturer who furnishes the material. Contractor shall submit a valid "Certificate of Eligibility" from the selected roofing materials manufacturer.
3. Contract Drawings and Specifications for roofing and flashings are diagrammatic and of a general nature only. Therefore, the manufacturer's specifications and flashing details shall govern as fully as if set forth herein, except as specifically indicated otherwise. All work shall be completed as required to obtain the required warranty and guaranty.
4. The Contractor shall review the Contract Drawings and Specifications with the roofing materials manufacturer and shall obtain manufacturer's concurrence that the selected roofing, insulation and its installation procedures, and flashing system are proper, compatible, and adequate for this application, and that the conditions and details indicated do not conflict with the recommendations of the manufacturer.
5. The Contractor and roofing materials manufacturer shall determine the probability of thermal and structural movement in the roofing system and shall provide for expansion and contraction in the roofing system as required to provide a serviceable roof without failures.

B. Roofing Manufacturer's Approval and Inspections:

1. Pre-roofing Conference: Contractor, roofing materials manufacturer's representative and the Engineer shall meet at the project site well in advance of the time schedules for roofing and other related work, and review requirements for the work and conditions which could possibly interfere with successful performance of the work.
2. Contractor shall arrange for the roofing materials manufacturer to render work-in-progress inspections to make certain that the materials used in the work are in accordance with these specifications, and they are being installed in accordance with this specification and the manufacturer's installation instructions and recommendations. Roofing materials manufacturer's inspector shall be present during the initial installation of insulation and placement of plies and intermittently thereafter at the inspector's discretion to assure the proper installation of roofing. At the completion of the job, promptly conduct final inspection with roofing materials manufacturer's representative and the Engineer. Manufacturer's inspector shall submit all field reports and manufacturer's certification to the Engineer.

1.08 GUARANTY OF ROOFING MATERIALS MANUFACTURER

- A.** Modified bitumen roofing and related flashing installations, including related metalwork, shall be guarantied against leakage, defective materials, and defective installation of the completed roofing work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, at no

additional expense to the District. Bulging or wrinkling of modified bitumen roof surfaces will also be interpreted as defects requiring correction.

- B. In addition to the guaranty requirements specified in General Conditions Article GC4.9, provide the roofing manufacturer's fifteen (15) year roofing system guaranty. Contractor will ensure that the District receives a proper transfer and assignment of the manufacturer's fifteen (15) year roofing guarantee. The terms of this guarantee shall include provision that it is a "no dollar limit" guarantee, that it covers all the manufacturer's materials comprising the roof, and that the manufacturer will promptly repair the roof to a watertight condition in the event of (1) normal wear and tear, (2) any deficiencies in the component materials or (3) any deficiencies in the workmanship of the Contractor in the application of the roof.

1.09 OTHER REQUIREMENTS

- A. Manufacturer shall submit proof of the following tests and requirements:
 1. Fire Testing: Materials shall be tested to a minimum of Class A fire rating in compliance with UL 790 and must bear testing agency's (Underwriter's Laboratories, etc.) mark.
 2. Wind Uplift: Roofing system shall be classified as Class I-90 in compliance with UL 580.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Roofing materials shall be delivered to the job-site in new, dry, unopened containers clearly showing catalog number, product description, manufacturer's name and location. Delivered quantities should be sufficient to assure continuous work.
- B. Materials shall be kept clean and protected from exposure to excessive heat or cold. Materials shall be stored in an enclosed area where the temperature is above 50 degrees or below 90 degrees Fahrenheit. Materials shall not be set directly on the ground. Labels shall not be removed nor protective covering torn-off until ready for application.
- C. Materials shall be protected from exposure to moisture in any form before, during, or after delivery to the site. Delivered materials showing evidence of contact with moisture shall be rejected.
- D. Materials shall not be double stacked nor stacked in a manner that could overload the roof structure.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Roofing Membranes:
 1. Base and Intermediate felts shall be premium fiberglass mat reinforced SBS (Styrene-Butadiene-Styrene) modified bitumen sheets conforming to or exceeding the requirements of ASTM D 6163, Grade S. These sheets shall be an elastomeric, asphaltic-blend product with a minimum thickness of 80 mils and roll weight of not less than 90 pounds (roll size=1.5 squares).

2. Cap shall be fire-resistant, premium fiberglass and polyester mat reinforced, white granular surfaced SBS (Styrene-Butadiene-Styrene) modified bitumen cap sheet conforming to or exceeding the requirements of ASTM D 6162, Grade G. Weight shall be at least 105 pounds per 100 square feet.
3. Base flashing shall be an elastomeric SBS modified bitumen sheet surfaced with factory applied white roofing granules. Base flashing shall meet or exceed the product specification of the cap.

B. Associated Materials: The contractor shall obtain in writing the approval from the roofing materials manufacturer on the use of any of the following associated materials if other than those supplied by the roofing materials manufacturer.

1. Cold Application Adhesive for the Field of the Roof: Mastic-type, one-part adhesive as recommended by the roofing materials manufacturer of the roofing system approved for this work, compatible with the materials and substrate to which the membranes are to be bonded.
2. Cold Application Adhesive for the Terminations and Base Flashing: Mastic-type, one-part adhesive as recommended by the roofing materials manufacturer of the roofing system approved for this work, compatible with the materials and substrate to which the membranes are to be bonded.
3. Flashing cement shall be asbestos-free adhesive specifically formulated for the SBS modified bitumen base flashing.
4. Cants shall be fire-resistant manufactured of compressed fiberglass or perlite board and/or fabricated of pressure treated Douglas Fir "Construction" or "No. 1" grade, as indicated on the Contract Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine roof deck insulation and other surfaces to receive roofing. These surfaces must be clean, smooth, flat, dry, and free from defects or irregularities, which can jeopardize the quality of the work. No roofing work shall be performed on defective areas until suitable corrections have been made.
- B. Inspect and approve the installation of roof deck insulation, sheet metalwork, wood nailers, metal framing members, roof specialties and accessories in connection with the roofing work. Refer to Section 07 22 00, Roof Deck Insulation, for roof deck insulation, refer to Section 07 60 00, Flashing and Sheet Metal, for metal flashing and sheet metalwork, refer to Section 07 70 00, Roof and Wall Specialties and Accessories, for roof specialties and accessories are in.

3.02 INSTALLATION

- A. Membrane Application: Installation of roofing membranes shall be in accordance with the materials manufacturer's specifications, instructions and recommendations for one-part cold adhesive application using only workers skilled and experienced in the installation of the type of work involved. Prior to application, Contractor shall review the specifications and the

MODIFIED BITUMEN ROOFING

manufacturer's technical manual with the manufacturer's technical representative to make certain that all aspects of membrane application is understood.

- B. A competent fore worker shall maintain constant supervision of the work.
- C. Install only as much complete roofing system that can be completed in one working shift. No section of roof shall be left exposed and unfinished at the end of each shift.
- D. Traffic shall be minimized on a freshly laid roof while the adhesive is still fluid.
- E. At the end of each working day, Contractor shall install temporary water cut-offs where roofing membrane does not abut a wall, wood edge member, or an expansion joint. All water cut-offs shall be removed cleanly when work resume. Roofing materials manufacturer's instruction shall be followed when installing water cut-offs.

3.03 FIELD QUALITY CONTROL

- A. After the completion of roofing and related work, a water ponding test shall be performed for all roof areas, parapets, curbs, penetrations, and accessories by applying a flood coat of water along the high areas so that water at least 1/4-inch deep flows over the areas. Tests shall be performed under the Engineer's observation.
- B. Roof drains shall be temporarily plugged, and at least one inch of water shall be allowed to stand on the roof for one hour. Should a leak or low spot appear, it shall be repaired, and the roof areas shall be retested until all work is watertight and acceptable.

END OF SECTION 07 52 16

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal flashing and trim
- B. Gutters and downspouts
- C. Miscellaneous sheet metalwork

1.02 RELATED SECTIONS

- A. Copper roofing, including related copper gutters and downspouts, is specified in Section 07 61 00 - Sheet Metal Roofing.
- B. Sheet metal ductwork for air distribution systems is specified in Section 23 31 00 - HVAC Ducts and Casings.

1.03 MEASUREMENT AND PAYMENT

- A. General: Flashing and sheet metalwork will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - 2. ASTM A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or A653M Zinc-iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM A924/A924M Specifications for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
 - 4. ASTM B29 Specification for Refined Lead
 - 5. ASTM B32 Specification for Solder Metal
 - 6. ASTM B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 7. ASTM B306 Specification for Copper Drainage Tube (DWV)
 - 8. ASTM B370 Specification for Copper Sheet and Strip for Building Construction

- B. Federal Specification (FS):
1. FS TT-S-230 Sealing Compound: Elastomeric Type, Single Component (For Calking, Sealing, and Glazing in Buildings and Other Structures)
 2. FS TT-S-1543 Sealing Compound: Silicone Rubber Base (For Calking, Sealing and Glazing in Buildings and Other Structures)
 3. FS UU-B-790 Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant)
- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): SMACNA Architectural Sheet Metal Manual

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings and Product Data: Submit detailed Shop Drawings of metal flashing and sheet metalwork, including gutters and downspouts, and installation details. Include manufacturers' product data for materials and manufactured items.

1.06 QUALITY ASSURANCE

- A. Flashing and sheet metalwork shall be fabricated and installed in accordance with SMACNA Architectural Sheet Metal Manual.
- B. Except where otherwise indicated, comply with minimum thickness or gage requirements as specified in SMACNA Architectural Sheet Metal Manual.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Galvanized Sheet Metal: Standard galvanized steel sheet, meeting requirements of ASTM A653/A653M and ASTM A924/A924M, as applicable, with minimum zinc coating of 1.25 ounces per square foot and 0.2 percent copper bearing, and mill phosphatized for maximum paint adherence. Where sheet metal gage is not indicated, provide 24 gage.
- B. Stainless Steel: Stainless steel sheet for architectural applications, meeting the requirements of ASTM A167, Type 304 or Type 316, with No. 4 finish. Where stainless steel sheet gage is not indicated, provide 26 gage.
- C. Sheet Copper: Standard cold-rolled copper sheet for building construction, conforming with ASTM B370, 16 oz., 20 oz., 24 oz., or 32 oz. per square foot as indicated or required. Where copper weights are not indicated, provide 16 oz. Gutters and downspouts shall be fabricated from 24 oz. copper. Cleats shall be 32 oz. copper.

- D. Copper Drainage Tube: Where downspouts are indicated as copper pipe or tube, provide DWV copper drainage tube conforming to ASTM B306. Provide for installation with standard copper, brass, or bronze fittings, as indicated, capable of being soldered. Coordinate with plumbing requirements specified under Division 15 - Mechanical.
- E. Aluminum Sheet Metal: ASTM B209, 5005 or 3003-H14 aluminum alloy as appropriate, clear anodized or epoxy coated. Where aluminum sheet thickness is not indicated, provide 0.0201 inch thickness.
- F. Sheet Lead: Standard 0.062 inch thick lead sheet weighing 4 pounds per square foot, arsenical-antimonial and pig lead alloy meeting the requirements of ASTM B29. Use sheet lead or tubing for flashing of vent pipes and other penetrations of the roof.
- G. Solder: Grade A meeting requirements of ASTM B32, composed of 50 percent pig lead and 50 percent block tin, warranted pure. Flux shall be an approved brand of soldering flux for the type of metal or muriatic acid neutralized with zinc.
- H. Building Paper: Rosin sized, unsaturated paper, weighing approximately 6 pounds per 100 square feet, or a water-repellent smooth building paper meeting requirements of FS UU-B-790, Type I, Grade A.
- I. Fasteners and Accessories: Furnish anchors and fasteners, washers, straps, and accessories required for a complete and finished installation. Fasteners and accessories shall conform with the following requirements:
1. Nails shall be stainless steel, hard copper, bronze, or brass. Where sheet metal is built in over roofing materials or other sheet metal, use nails or screws with 1 inch matching nonferrous washers. Screws shall be standard stainless steel, brass, or bronze wood screws, as required. Sheet metal screws shall be self-drilling, self-tapping stainless steel or tempered non-corrodible steel of proper size and length to suit conditions.
 2. Screw heads shall be furnished with neoprene washers.
 3. Straps: Straps and miscellaneous fastenings, where required, shall be stainless steel, half-hard copper, or half-hard 70-30 brass of size indicated or required. Where not indicated, provide straps of 1/16 inch thick by 1 inch wide size.
- J. Sealant: Calking or sealing compound shall be a silicone synthetic rubber elastomeric sealant which cures at normal temperature to a flexible firm rubber, tack free, in gun grade consistency. Sealant shall be specially designed for adhesion to the surfaces to which it will be applied, and shall meet or exceed the minimum requirements of FS TT-S-230 or FS TT-S-1543, as applicable.
- K. Isolating Material: Alkali-resistant bituminous paint or varnish.

2.02 FABRICATION AND SHOP PAINTING

- A. Form and fabricate sheet metalwork as indicated and in accordance with the approved Shop Drawings and SMACNA Architectural Sheet Metal Manual. Properly reinforce sheet metalwork as required for strength and appearance.
- B. Galvanized sheet metal surfaces which will be concealed in the finished work shall be chemically treated or etched to assure maximum paint adherence and then shop painted with one coat of an approved galvanized primer as specified in Section 05 50 00 - Metal Fabrications. Finish field painting is specified in Section 09 91 00 - Painting.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation Standards: Install flashing and sheet metalwork as indicated and in accordance with the approved Shop Drawings and SMACNA Architectural Sheet Metal Manual.
- B. Flashing and Metal Trim: Provide flashing, counterflashing, cap flashing, metal trim, and any other fabricated items and miscellaneous sheet metalwork indicated or required to provide a complete and watertight installation.
- C. Gutters and Downspouts: Install gutters and downspouts as indicated and in accordance with the approved Shop Drawings and pertinent provisions of SMACNA Architectural Sheet Metal Manual.
- D. Work Quality:
 1. Sheet metalwork shall be finished straight and true, with miters and joints accurately fitted. Exposed work shall be free of dents and other defects. Corners shall be reinforced and seams made waterproof. Edges of sheet metal shall be hemmed.
 2. Provide for expansion and contraction in sheet metal assembly by means of expansion joints or other appropriate methods of SMACNA Architectural Sheet Metal Manual. Provide reinforcement as required.
 3. Isolate and protect dissimilar metals from contact with each other by applying specified isolation material to contact surfaces. Protect surfaces of sheet metal in contact with concrete, treated wood, or aluminum with a heavy coating of bituminous paint.
 4. Provide waterproof neoprene washers wherever required fasteners penetrate sheet metal. Exposed fasteners will not be permitted for any portion of this work.
- E. Calking and Sealing: Calk or seal joints and laps of sheet metalwork as indicated or required for a waterproof installation. Beads of sealant which will be concealed in the finished work shall be continuous with no voids of material. Interface and coordinate the calking and sealing work of this Section with the work specified in Section 07 90 00 - Joint Protection.
- F. Flashing for Roof Penetrations:
 1. Flashing of roof penetrations shall be 4 pound lead. Flashing shall be accurately formed to conform with roofing contours and configurations and as required to assure a

FLASHING AND SHEET METAL

watertight installation. Flashing shall be built in as the roofing work progresses. Flash and burn lead against any penetrations through its surface.

2. Except as indicated otherwise, plumbing and mechanical vent flashing shall be of 4 pound lead tubing. Flanges shall be minimum 18 inches square, and tubing shall be long enough to permit turning lead into the end of vent pipe.

END OF SECTION 07 60 00

BART Facilities Standards (BFS)

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SECTION 07 61 00

SHEET METAL ROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Copper sheet roofing
- B. Copper gutters, down spouts
- C. Copper flashing and trim

1.02 MEASUREMENT AND PAYMENT

- A. Measurement: Copper roofing, including gutters, downspouts, and related flashings, will be measured for payment by the lump-sum method, acceptably furnished and installed.
- B. Payment: Copper roofing, including gutters, downspouts, and related flashings, will be paid for at the Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B29 Specification for Refined Lead
 - 2. ASTM B32 Specification for Solder Metal
 - 3. ASTM B370 Specification for Copper Sheet and Strip for Building Construction
 - 4. ASTM D2178 Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
- B. Federal Specification (FS):
 - 1. TT-S-230 Sealing Compound: Elastomeric Type, Single Component, Chemically Curing (For Calking, Sealing, and Glazing in Buildings and Other Structures)
 - 2. TT-S-1543 Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures)
 - 3. UU-B-790 Building Paper, Vegetable Fiber Kraft (Waterproofed, Water Repellent and Fire Resistant)
- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

SMACNA Architectural Sheet Metal Manual

- D. Underwriters Laboratories Inc. (UL)
 - UL 580 Tests for Uplift Resistance of Roof Assemblies
 - UL 790 Tests for Fire Resistance of Roof Covering Materials

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittals, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings and Product Data: Submit detailed Shop Drawings of copper roofing and related gutters and downspouts and installation details for review. Include manufacturer's product data for copper materials and manufactured items. Include manufacturer's specifications and details for a pre-engineered, factory-manufactured roofing system.
- C. Samples:
 - 1. Submit two sample squares, 8 by 10 inches in size, of the copper pan sheet.
 - 2. Submit sample standing-seam or batten-seam assembly, as indicated.
 - 3. Submit samples of anchors and mechanical fasteners proposed for use for the type of substrate.

1.05 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Comply with applicable requirements of the California Building Code, Chapter 15, Roofs and Roof Structures.
 - 2. Roofing shall meet Underwriters Laboratories' requirements for Class A copper roofing assembly in compliance with UL 790 and Class 90 wind uplift resistance in compliance with UL 580.
 - 3. Shop or site fabricated sheet copper roofing shall be fabricated and installed in accordance with SMACNA Architectural Sheet Metal Manual, applicable Charts and Plates, and related specifications.
 - 4. Pre-engineered and factory-manufactured copper roofing shall meet all requirements specified herein and shall be installed in accordance with the roofing manufacturer's installation instructions and written recommendations
 - 5. Supervise waterproofing underlayment and flashings of roof penetrations in connection with copper roofing work.
- B. Performance Requirements:

1. Copper sheet roofing work, gutters and downspouts, and related flashings shall be fabricated and installed by a licensed subcontractor, skilled and experienced in the type of work involved.
2. The Contractor and copper roofing materials manufacturer or supplier/installer shall design roof-edge details to prevent wind-uplift and damage to the roof from high winds and storms.
3. The Contractor and copper roofing material manufacturer or supplier/installer shall determine the probability of thermal and structural movement in the roofing system and shall provide for expansion and contraction in the roofing system as required to provide a serviceable roof without failures.
4. Provide copper roofing capable of withstanding thermal expansion and contraction movements for an ambient temperature change of 150 degrees F. without failure, including air and water leakage, and without noise from metal-to-metal contact in movement.

C. Copper Roofing Manufacturer's Field Services:

1. Where the roofing is to be a pre-engineered, factory-manufactured roofing system, the copper roofing materials' manufacturer shall inspect and approve all copper roofing installations and shall provide field services at no additional cost to the District.
2. The Contractor shall make all necessary arrangements with the manufacturer of the materials to be installed to provide on-site consultation and inspection services to ensure the proper installation of the copper roof and related flashings.
3. The manufacturer's representative shall be present at the time any phase of the work is performed. Copper roofing shall be applied only over surfaces previously approved by the manufacturer's representative.

1.06 ENVIRONMENTAL CONDITIONS AND PROTECTION

- A. Provide protection of all station and building roof areas from moisture and rain. Provide water-repellent coverings as required. Leave no unroofed deck areas exposed to moisture and rain at any time, prior to installation of roofing.

1.07 GUARANTY

- A. Copper roofing and related flashing installations shall be guaranteed against leakage, defective materials, and inferior work quality of the completed work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, at no additional cost to the District.
- B. In addition to the guaranty requirements specified in General Conditions Article GC4.9, provide a 5-year roofing system guaranty or warranty, which shall state in essence that the Contractor and roofing installer shall, at their expense, make or cause to be made any repairs necessary to maintain the applied roof and related flashings in a watertight condition for a period of five years. The guaranty shall be effective from the date of Substantial Completion, and shall be

signed by the roofing installer and countersigned by the Contractor, and shall be submitted to the Engineer as specified in Section 01 77 00 - Closeout Procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Roof Type: Copper roofing system shall be of the type indicated, shop or site fabricated or factory-manufactured standing-seam or batten-seam system suitable for the site installation conditions. All materials for shop or site fabricated roofing system shall conform with the SMACNA Architectural Sheet Metal Manual. Site fabricated batten-seam roofs shall employ pressure-treated preservative wood battens. Factory-manufactured batten-seam roofs may employ a snap-on structural batten system of indicated profile.
- B. Sheet Copper: Standard cold-rolled copper sheet for building construction, conforming with ASTM B370, 16 oz., 20 oz., 24 oz., or 32 oz. per square foot as indicated or required. Where copper weights are not indicated, provide 16 oz. copper sheet. Provide sheets in as long lengths as practical to minimize joints. Gutters and downspouts shall be fabricated of 24 oz. copper. Cleats shall be minimum 20 oz. copper. Copper finish shall be as indicated.
- C. Sheet Lead: Standard 0.062-inch thick lead sheet weighing 4 pounds per square foot, arsenical-antimonial and pig lead and tubing alloy meeting the requirements of ASTM B29. Use sheet lead and tubing for flashing of vent pipes and other penetrations of the roof.
- D. Solder: Grade A meeting requirements of ASTM B32, composed of 50 percent pig lead and 50 percent block tin, warranted pure. Flux shall be an approved brand of soldering flux for copper or muriatic acid neutralized with zinc.
- E. Wood Nailers and Battens: Wood nailers and battens shall be "Construction" or "No. 1" grade Douglas fir, pressure-treated with preservative, as specified in Section 06 10 00 - Rough Carpentry, of size and dimensions indicated or required. Moisture content shall not exceed 19 percent.
 - 1. Anchors and Fasteners: Wood nailers and battens shall be anchored to metal decking with self-drilling, self-tapping, tempered steel screws manufactured for the purpose of securing items to metal decking. Screws shall be specially treated to prevent corrosion. Wood nailers and battens shall be anchored to concrete substrates with expansion-type anchors as specified in Section 05 50 00 - Metal Fabrications.
- F. Roofing Felt: Asphalt-saturated glass felt, conforming with ASTM D2178 and weighing 30 pounds per 100 square feet.
- G. Building Paper (Slip Sheet): Rosin-sized, unsaturated paper, weighing approximately 6 pounds per 100 square feet, or a water-repellent smooth building paper meeting requirements of FS UU-B-790.
- H. Fasteners and Accessories: Furnish anchors and fasteners, washers, straps, and accessories required for a complete and finished installation. Fasteners and accessories shall conform with the following requirements:

1. Nails shall be hard copper, bronze, or brass. Where sheet metal is built in over roofing materials or other sheet metal, use nails or screws with 1-inch copper washers. Rivets shall be soft copper rivets. Screws shall be standard brass or bronze wood screws, as required. Sheet metal screws shall be self-drilling, self-tapping stainless steel or tempered non-corrodible steel of proper size and length to suit conditions.
 2. Screw heads shall be furnished with neoprene washers.
 3. Straps: Straps and miscellaneous fastenings, where required, shall be half-hard copper or half-hard 70-30 brass of size indicated or required. Where not indicated, provide straps of 1/8-inch thick by 1-inch wide size.
- I. Sealant: Calking or sealing compound shall be a silicone synthetic rubber elastomeric sealant that cures at normal temperature to a flexible firm rubber, tack free, in gun grade consistency. Sealant shall be specially designed for adhesion to the surfaces to which it will be applied, and shall meet or exceed the minimum requirements of FS TT-S-230 or FS TT-S-1543, as applicable.
 - J. Dielectric Isolating Material: Alkali-resistant bituminous paint or varnish.

2.02 FABRICATION

- A. Form and fabricate standing-seam copper roofing, gutters, downspouts, and related flashings as indicated and in accordance with the approved Shop Drawings and the SMACNA Architectural Sheet Metal Manual. Properly reinforce sheet copper roofing as required for strength and appearance.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION OF SUBSURFACES

- A. Examination of Roof Deck Surfaces: Before starting the installation of any roofing work, examine all surfaces that the copper roofing and flashings are to be applied.
- B. Cleaning and Preparation of Subsurfaces: Surfaces that copper roofing and flashings are to be applied shall be dry, clean of dirt and dust. Surfaces shall also be free from sharp protrusions and defective surfaces which will prevent a level and plane installation. Fill all joints, cracks, or depressions in subsurfaces with patch or underlayment material recommended by the manufacturer of the copper roofing system components.
- C. Responsibility: Nothing specified herein shall be construed as relieving the Contractor of full responsibility for the waterproof quality of the finished installation. Surfaces that copper roofing and flashings are to be applied shall be in proper condition in every respect for installation of the copper roofing and flashings.
- D. Protection: Protect structures to be roofed from moisture and rain until completion and acceptance of the roofing work

3.02 INSTALLATION**A. Installation Standards:**

1. Install shop or site fabricated standing-seam or batten-seam sheet copper roofing and related gutters, downspouts, and flashings as indicated and in accordance with the approved Shop Drawings and the SMACNA Architectural Sheet Metal Manual.
2. Install factory-manufactured copper roofing and related gutters, downspouts, and flashings as indicated and in accordance with the approved Shop Drawings and the materials' manufacturer's installation instructions and written recommendations.

B. Flashings and Metal Trim: Provide flashings, counterflashings, ridge flashings, metal trim, and any other fabricated items and miscellaneous copper sheet metalwork indicated or required to provide a complete and watertight installation.**C. Gutters and Downspouts:** Install gutters and downspouts as indicated and in accordance with the approved Shop Drawings and pertinent provisions of the SMACNA Architectural Sheet Metal Manual.**D. Work Quality:**

1. Standing-seam and batten-seam sheet copper roofing shall be finished straight and true. Exposed work shall be free of dents and other defects. Corners shall be reinforced and seams made waterproof. Edges of sheet copper shall be hemmed.
2. Provide for expansion and contraction in sheet copper roofing and gutters by means of expansion joints or other appropriate methods of the SMACNA Architectural Sheet Metal Manual. Provide reinforcement as required.
3. Isolate and protect dissimilar metals from contact with each other by applying a heavy coating of the specified isolation material to contact surfaces.
4. Provide waterproof neoprene washers wherever required fasteners penetrate sheet metal. Exposed fasteners will not be permitted for any portion of this work.
5. Gutters shall have bottoms that slope continuously from expansion joints to downspout outlets as indicated.

E. Calking and Sealing: Calk or seal joints and laps of sheet copper as indicated or required for a waterproof installation. Beads of sealant that will be concealed in the finished work shall be continuous with no voids of materials. Interface and coordinate the calking and sealing work of this Section with the work specified in Section 07 90 00 - Joint Protection.**F. Flashings for Roof Penetrations:**

1. Flashings of roof penetrations shall be 4-pound lead. Flashings shall be accurately formed to conform with roofing contours and configurations and as required to assure a watertight installation. Flashings shall be built in as the roofing work progresses. Flash and burn lead against any penetrations through its surface.

2. Except as indicated otherwise, plumbing and mechanical vent flashings shall be of 4-pound lead tubing. Flanges shall be minimum 18-inches square, and lead tubing shall be long enough to permit turning lead into the end of vent pipe.

3.03 FIELD QUALITY CONTROL

- A. After completion of copper roofing and related work, a water test shall be performed for all roof areas, penetrations, and accessories by applying a sheet of water along the ridge or other high areas. The test shall be performed under the Engineer's observation.
- B. Should a leak appear, it shall be repaired, and the roof areas shall be retested as specified above until all work is watertight and acceptable.

END OF SECTION 07 61 00

BART Facilities Standards (BFS)

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SECTION 07 70 00

ROOF and WALL SPECIALTIES and ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roof hatches
- B. Smoke vents
- C. Gravity vents
- D. Equipment roof curbs
- E. Reglets and counterflashings
- F. Metal fascia and gravel stops

1.02 MEASUREMENT AND PAYMENT

- A. General: Roof specialties and accessories will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
 - 2. ASTM A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM A526/A526M Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
 - 4. ASTM B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 5. ASTM B370 Specification for Copper Sheet and Strip for Building Construction
 - 6. ASTM D2822 Specification for Asphalt Roof Cement
 - 7. ASTM D4586 Specification for Asphalt Roof Cement, Asbestos-Free
- B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. SMACNA Architectural Sheet Metal Manual

- C. Underwriters' Laboratories Inc. (UL):
 - 1. UL Building Materials Directory

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit detailed Shop Drawings for the fabrication and installation of custom fabricated roof specialty and accessory units. Show jointing, anchorage, accessory items, and flashings.
- C. Product Data: Submit manufacturer's or fabricator's standard drawings and installation instructions for each roof specialty and accessory unit required, including product data to indicate compliance with the Contract Documents.
- D. Certification: Submit certification of fire-resistance ratings as required for smoke-vent assemblies.

PART 2 - PRODUCTS

2.01 FABRICATION REQUIREMENTS

- A. Provide standard manufactured products for roof specialties and accessories as indicated, modified where necessary to meet requirements.
- B. Custom fabricate units or components that are not available as standard manufactured products.
- C. Fabricate each item in the shop as a complete unit for coordination with adjoining work. Provide mounting curb, anchorage and flashing flanges, offsets to accommodate insulation thicknesses, cant strips and nailers for roofing, expansion sleeves (concealed on exposed fascias), hardware and noncorrosive bearings for operating parts, and gaskets and sealant recesses as required to make the installation weathertight.
- D. Where exposed fasteners are necessary, provide stainless steel self-tapping screws or bolts.
- E. Wherever a fire-resistance rating is indicated for construction or surfaces that roof specialties or accessories are to be installed, provide an assembly of type and manufacture listed in the UL Building Materials Directory. Provide UL or equivalent Classification Marking or Label on each fire-rated assembly.

2.02 MATERIALS

- A. Galvanized Sheet Metal: Standard galvanized steel sheet, meeting requirements of ASTM A563/A563M and ASTM A526/A526M, with minimum zinc coating of 1.25 ounces per square foot and 0.2 percent copper bearing, and mill phosphatized for maximum paint adherence.

- B. Stainless Steel: Stainless steel sheet for architectural applications, meeting the requirements of ASTM A167, Type 304 or Type 316, with No. 4 finish.
- C. Aluminum Extrusions: Extrusions for reglets, fascia, and gravel stops, where indicated, shall be 6061-T6 aluminum alloy, with minimum thickness of 0.094 inch.
- D. Aluminum Sheet Metal: ASTM B209, 5005 or 3003-H14 aluminum alloy as appropriate.
- E. Copper: Standard cold-rolled copper sheet for building construction, conforming with ASTM B370, 24 oz or 32 oz. per square foot as indicated or required.
- F. Bituminous Plastic Cement: ASTM D2822 or ASTM D4586.

2.03 ROOF HATCH (SCUTTLE)

- A. Roof scuttles shall be of sizes indicated, furnished complete with all necessary hardware and installation accessories. Curb and cover shall be fabricated from 14 gage steel, and cover liner from 22 gage steel. Provide cover with rubber draft seal. Cover insulation shall be glass fiber, minimum 1 inch in thickness.
- B. Roof scuttle shall be galvanized, treated for paint adherence, and shop coated with an approved metal primer before delivery.
- C. Provide roof scuttle complete with required operating hardware, including positive snap latch with turn handles and padlock hasps inside and outside. Hardware shall be non-ferrous or zinc-plated.

2.04 SMOKE VENT

- A. Provide smoke-relief vent hatch of type and size indicated, with automatic door-opening operation, furnished complete with necessary installation accessories. Construct units of manufacturer's standard gages of metal, designed for a live load of 40 pounds per square foot. Smoke vent shall be galvanized, treated for paint adherence, and shop coated with an approved baked-on corrosion-inhibitive metal primer.
- B. Provide hatch doors with metal cover and cover liner, insulated with minimum 1-inch thick glass fiber insulation, rubber gaskets, spring hinges loaded to open against 10 pounds per square foot wind load, automatic release mechanism with 160 degree F UL-listed fusible link, and manual release latch and pull device. Provide smoke vent with emergency release device.
- C. Smoke vent shall be Listed by Underwriters' Laboratories Inc. under "Roof Vents, Automatically Operated," and shall be Factory Mutual approved to assure dependable performance.

2.05 GRAVITY VENTS

- A. Provide gravity ventilators of throat size, free-air opening, and configuration as indicated. Units shall be manufactured of galvanized steel or aluminum, anodized or clear epoxy-coated. Units shall be weatherproof, and shall not permit the intrusion of water during inclement weather.

2.06 EQUIPMENT ROOF CURBS

- A. Provide curb units and components for roof-mounted mechanical and electrical equipment of types and sizes as indicated, furnished complete with necessary installation accessories. Fabricate units from galvanized steel sheets, with joints and seams welded for weathertight construction. Use 14 gage steel, unless otherwise indicated. Provide integral counterflashing formed to receive built-up or single-ply roofing. Curb units shall be sized to carry weight of equipment to be supported.
- B. Form walls vertically with flanges as indicated for anchorage to deck, ready to receive roof insulation and cant strips. Insulate walls of units with minimum 1-inch thick rigid glass fiber insulation, set inside of metal wall. Provide 22 gage metal liner, extended through opening and flanged at lower edge as indicated. Use perforated or expanded metal for liner, to form sound-absorbing surfaces in unit.
- C. Provide pressure-treated wood nailers of sizes indicated, anchored to top flanges of unit in accordance with manufacturer's standard details. If size is not indicated, provide nominal 1-inch thick wood or plywood.
- D. Curb metalwork shall be galvanized, treated for paint adherence, and shop coated with an approved baked-on corrosion-inhibitive prime coat, inside and out.

2.07 REGLETS AND COUNTERFLASHINGS

- A. Reglets and counterflashings shall be stainless steel, as indicated.
- B. Reglets shall be heavy-gage stainless steel of type and configuration indicated, of strength required to hold rigidly and securely spring-locked counterflashing.
- C. Counterflashings shall be 26 gage stainless steel. Counterflashings shall be shop or factory formed so that the counterflashings shall mate with and lock rigidly into the reglets.

2.08 FASCIA AND GRAVEL STOPS

- A. Provide shop-fabricated fascia and gravel-stop units of types, sizes, profiles, and materials indicated or specified, to form a complete and continuous weatherproof trim system at the edge of the roofing, complete with prefabricated corner units, expansion joints, and anchorage devices.
- B. Form concealed units from manufacturer's standard metal gages, but not less than 20 gage steel.
- C. Fabricate exposed fascia trim units from extruded aluminum of thickness, alloy, temper, and hardness recommended by the manufacturer. Extruded aluminum shall be protected with a coating of 0.5 mil clear methacrylate lacquer.
- D. Fabricate exposed copper fascia, as indicated, from minimum 32 ounce copper sheet. Comply with applicable requirements and details of SMACNA Architectural Sheet Metal Manual.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate surfaces and components to receive roof specialties and accessories and correct conditions detrimental to the proper and timely completion of the work. Do not proceed with installation work until unacceptable conditions have been corrected and accepted.

3.02 INSTALLATION

- A. Install roof specialty and accessory units as indicated and in accordance with the respective manufacturer's installation instructions. Install each unit plumb and level, true to line, and coordinated with adjacent related work. Anchor accessories securely to the substrate. Set flanges of units in bituminous plastic cement, and leave surfaces smooth and clean for application of roofing and flashing.
- B. Installation shall be coordinated and integrated with roofing work, properly flashed, and shall be watertight upon completion.

END OF SECTION 07 70 00

BART Facilities Standards (BFS)

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SECTION 07 81 16

CEMENTITIOUS FIREPROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cementitious direct spray-applied fireproofing

1.02 MEASUREMENT AND PAYMENT

- A. General: Sprayed-on cementitious fireproofing will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):

1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
2. ASTM E119 Test Method for Fire Tests of Building Construction and Materials
3. ASTM E605 Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
4. ASTM E736 Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
5. ASTM E759 Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
6. ASTM E760 Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
7. ASTM E761 Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members
8. ASTM E859 Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members
9. ASTM E937 Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
10. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

- B. International Conference of Building Officials, Uniform Building Code (UBC):

1. UBC Standard 7-6, Thickness and Density Determination for Spray-Applied Fireproofing

C. Underwriters Laboratories Inc. (UL):

1. UL Fire Resistance Directory; applicable UL Design Numbers for application of spray-applied fireproofing and conditions as indicated.

1.04 SYSTEM DESCRIPTION

System includes one-hour, two-hour, and three-hour fire-rated protection for structural steel members and for underside of steel decking as indicated

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:
1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 7, "Fire-Resistant Materials and Construction."

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit manufacturer's product data of the cementitious fireproofing material proposed for this work.
- C. Certificates: Submit certificates from a testing laboratory acceptable to the Engineer, attesting that fire protection material and installation methods meet specified fire hazard classifications and fire resistance ratings. Certificates shall also list thicknesses and density of material proposed for use.

1.07 QUALITY ASSURANCE

- A. Regulatory Requirements: Spray-applied fireproofing shall meet or exceed the applicable requirements of the California Building Code, Chapter 7, "Fire-Resistant Materials and Construction," and the applicable UL Design Numbers and code approvals for the application of the one-hour, two-hour, and three-hour fire protections indicated.
- B. Qualifications: Application of the spray-applied fireproofing material shall be by a skilled and experienced applicator specializing in the application of spray-applied fireproofing. Fireproofing applicator shall be approved by the manufacturer who furnishes the materials. Submit proof of this in writing to the Engineer before starting the fireproofing application.
- C. Manufacturer's Field Services:
1. The Contractor shall make necessary arrangements with the manufacturer of the materials to be applied to provide on-site consultation and inspection services to ensure the proper application of the cementitious fireproofing material.
 2. At completion of the work, the manufacturer shall submit written certification that

fireproofing material was applied over inspected and approved base steel components and that fireproofing material was applied correctly in accordance with these Specifications and the manufacturer's specifications and recommendations.

1.08 DELIVERY AND STORAGE

- A. Materials shall be delivered to the site in sealed packages properly marked and labeled to show manufacturer's name, brand, and certification of compliance with requirements for fire hazard and fire-resistance classifications. Damaged packages found unsuitable for use in the work will be rejected and shall be removed from the site. Store materials under cover in a dry location.

1.09 PROJECT CONDITIONS

- A. Surfaces that fire protection material is to be applied, as well as the ambient temperature during application and for 24 hours after application, shall not fall below 45 degrees F. Relative humidity shall be low enough to assure proper drying of the applied material.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Fireproofing Material: Factory-blended, cementitious direct spray-applied, non-flaking and non-dusting, type fireproofing material, with mold and fungi inhibitor added by the manufacturer. Fireproofing material shall be labeled by the Underwriters Laboratories, Inc., for fire hazard classification, and evidence of the UL Classification Marking shall appear on the packages of all fireproofing material. Material containing asbestos will not be acceptable. Material shall contain the following properties and characteristics:
1. Fire-Retardant Requirements: Fireproofing material shall have been tested, classified, and listed by the Underwriters Laboratories Inc. in accordance with the provisions of ASTM E119.
 - a. Surface Burning Characteristics: Fireproofing material shall have a flamed-spread rating of 10 or less and a smoke-developed contribution of 0 when tested in accordance with ASTM E84.
 2. Applied Dry Density: Provide for minimum dry density in place, when tested in accordance with ASTM E605, as required by applicable UL Design Number and UBC Standard 7-6 for the indicated application.
 3. Bond Strength: Minimum bond strength between fireproofing material and steel members shall be 200 pounds per square foot when tested in accordance with ASTM E736.
 4. Deflection: Material shall not crack or delaminate from the surface that it is applied when tested in accordance with ASTM E759.
 5. Bond Impact: Material shall not crack or delaminate from the surface that it is applied when tested in accordance with ASTM E760.

6. Compressive Strength: Material shall not deform more than 10 percent when subjected to compressive forces of 500 pounds per square foot in accordance with test requirements of ASTM E761.
 7. Air Erosion: Maximum allowable weight loss of the material shall be 0.025 grams per square foot when tested in accordance with ASTM E859.
 8. Corrosion Resistance: Applied material shall not promote corrosion of steel when tested in accordance with ASTM E937.
 9. Fungi Growth Resistance: Applied material shall not support mold growth when tested in accordance with ASTM G21.
- B. Water: Fresh, clean and potable, and free from such amounts of mineral and organic substances as would adversely affect the strength, cohesion, and adhesion of the fireproofing material.

2.02 MIXING

- A. Mixing of fireproofing materials shall be in accordance with the manufacturer's instructions and recommendations. Material and water ratio shall be mechanically controlled.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that items that will penetrate fireproofing, including clips and hangers for suspended ceilings, piping, and conduits are properly located and installed.
- B. Verify that interfacing installations are complete as indicated.

3.02 PREPARATION OF SURFACES

- A. Surfaces that spray-on fireproofing will be applied shall be cleaned of oil, grease, dirt, loose paint, mill scale, or any other matter that may impair bond of fireproofing material to steel. Galvanized decking material with lubricant shall be solvent washed and dried before application of fireproofing.
- B. Provide suitable templates, masking, or coverings to stop fireproofing material and overspray at exposed finished surfaces in sharp and neat straight lines. Provide for protection of floors and equipment from spillage, overspray, and rebound.

3.03 APPLICATION

- A. Application of fireproofing materials shall be in accordance with the application instructions and recommendations of the materials' manufacturer and the fire test reports' information. Adhesive and sealer, when not an integral part of the material, shall be applied in accordance with manufacturer's recommendations.
- B. Fireproofing material shall be applied in minimum thicknesses as required to meet UL Design requirements and code approvals for one-hour and two-hour fire protections as indicated.

- C. When test reports require tamping of sprayed-on material, provide such tamping in accordance with the manufacturer's instructions and recommendations.

3.04 PATCHING AND REPAIRING

- A. Perform patching and repairing of fireproofing material as required to provide the one-hour, two-hour, and three-hour fire protection and related thicknesses. Include all patching and repairing of fireproofing material required after the work of other trades has been installed, such as piping and conduits, ductwork, metal stud partitions, ceiling suspension systems, and similar work. Re-apply fireproofing material as required to maintain fire-resistive continuity.

3.05 FIELD QUALITY CONTROL

- A. Corrective measures, when necessary, shall be performed as required. The Contractor shall require that the manufacturer of the fireproofing material submit recommendations for corrective measures to the Engineer for approval.
- B. The Contractor shall take frequent, random probe measurements, as witnessed by the Engineer, of applied material to verify compliance with thickness requirements.
- C. The Contractor shall take field samples of fireproofing material, randomly selected, for laboratory tests to verify compliance with specified density and compressive-strength requirements. Submit such laboratory reports to the Engineer for record purposes.

END OF SECTION 07 81 16

BART Facilities Standards (BFS)

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SECTION 07 81 24

INTUMESCENT FIREPROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Epoxy-based intumescent fireproofing.
- B. Decorative topcoat finish.
- C. Primer.

1.02 SYSTEM DESCRIPTION

- A. System includes one hour and two hour fire-rated protection for structural steel members as indicated.
- B. Fireproofing material shall be an epoxy-based intumescent fireproof coating. Provide decorative topcoat for exposed portions of structural steel only.

1.03 RELATED SECTIONS

- A. Compatible primer for structural steel is specified in Section 05 12 00 - Structural Steel Framing.

1.04 MEASUREMENT AND PAYMENT

- A. General: Intumescent fireproofing will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.05 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM E119 Test Method for Fire Tests of Building Construction and Materials
- B. Steel Structures Painting Council (SSPC):
 - 1. Steel Structures Painting Manual, Volume 2, "Systems and Specifications"
- C. Underwriters Laboratories Inc. (UL):
 - 1. UL Fire Resistance Directory; applicable UL Design Numbers for application of fireproofing and conditions as indicated.

1.06 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:

California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 7, "Fire-Resistant Materials and Construction."

1.07 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit manufacturer's product data of the intumescent fireproofing material proposed for this work, indicating product characteristics, performance, and limitations. Include topcoat coating material and color samples for exposed steel surfaces.
 - 1. Color of the topcoat in exposed locations requires the approval of the Engineer before the topcoat may be used in the work.
- C. Certificates: Submit certificates from an independent testing laboratory, attesting that fire protection material and installation methods meet specified fire hazard classifications and fire resistance ratings.

1.08 QUALITY ASSURANCE

- A. Regulatory Requirements: Intumescent fireproofing shall meet or exceed the applicable requirements of the California Building Code, Chapter 7, and the applicable UL Design Number and code approval for the application of the one-hour and two-hour fire protection indicated.
- B. Qualifications: Application of the intumescent fireproofing material shall be by a skilled and experienced applicator specializing in the application of intumescent fireproofing. Fireproofing applicator shall be approved by the manufacturer who furnishes the materials.
- C. Manufacturer's Field Services:
 - 1. The Contractor shall make necessary arrangements with the manufacturer of the materials to be applied to provide on-site consultation and inspection services to ensure the proper application of the intumescent fireproofing material.
 - 2. At completion of the work, the manufacturer shall submit written certification that fireproofing material was applied over inspected and approved base steel components and that fireproofing material was applied correctly in accordance with these Specifications and the manufacturer's specifications and recommendations.

1.09 DELIVERY AND STORAGE

- A. Materials shall be delivered to the site in sealed containers properly marked and labeled to show manufacturer's name, brand, and certification of compliance with requirements for fire hazard and fire resistance classifications. Damaged containers found unsuitable for use in the work will be rejected and shall be removed from the site. Store materials under cover in a dry location.

1.10 PROJECT CONDITIONS

- A. Surfaces to which fire protection material is to be applied, as well as the ambient temperature during application and for 24 hours after application, shall not fall below 50 degrees F. Relative humidity shall be low enough to assure proper drying of the applied material.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Fireproofing Material: Epoxy-based intumescent fireproofing material for spray or brush application, with a dry film thickness of not less than 0.26 inch as required to achieve the specified one-hour and two-hour fire-resistive ratings. Fireproofing material shall be labeled by the Underwriters' Laboratories, Inc., for fire hazard classification, and evidence of the UL Classification Marking shall appear on the containers of all fireproofing material. Material containing asbestos will not be acceptable. Material shall contain the following properties and characteristics:
1. Fire-Retardant Requirements: Fireproofing material shall have been tested, classified, and listed by the Underwriters Laboratories Inc. or Warnock Hersey in accordance with the provisions of ASTM E119.
 2. Surface Burning Characteristics: Fireproofing material shall have a flame-spread rating of 25 or less when tested in accordance with ASTM E84.
 3. VOC Regulations: Fireproofing material shall comply with applicable California VOC Regulations as specified in Section 01 60 00 - Product Requirements.
- B. Decorative Topcoat Finish Material: Provide topcoat coating material for exposed steel as recommended by the fireproofing material manufacturer in color as selected by the Engineer.
- C. Primer: Factory-applied primer with adhesion and compatibility characteristics necessary for the successful application of the fireproofing material as specified in Section 05 12 00 - Structural Steel Framing.

2.02 MIXING

- A. Mixing of fireproofing materials shall be in accordance with the manufacturer's instructions and recommendations.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify that items that will penetrate fireproofing, including clips and hangers for piping and conduits, are properly located and installed.
- B. Verify that interfacing installations are complete as indicated.

3.02 PREPARATION OF SURFACES

- A. Surfaces to which intumescent fireproofing will be applied shall be cleaned of oil, grease, dirt, loose paint, mill scale, or any other matter that may impair bond of fireproofing material to steel.
- B. Provide suitable templates, masking, or coverings to stop fireproofing material and overspray at exposed finished surfaces in sharp and neat straight lines. Provide for protection of floors and equipment from spillage and overspray.

3.03 APPLICATION

- A. Application of fireproofing materials shall be in accordance with the application instructions and recommendations of the materials' manufacturer and the fire test reports' information.
- B. Fireproofing material shall be applied in minimum thickness of 0.26 inch and as required to meet UL Design requirements and code approval for one-hour and two-hour fire protection of structural steel.
- C. Apply decorative finish coating over intumescent fireproofing for exposed steel surfaces in accordance with the manufacturer's application instructions and recommendations.

3.04 PATCHING AND REPAIRING

- A. Perform patching and repairing of fireproofing material as required to provide the one-hour and two-hour fire protection and related thickness. Include all patching and repairing of fireproofing material required after the work of other trades has been installed, such as piping and conduits, ductwork, and similar work. Re-apply fireproofing material as required to maintain fire-resistive continuity.

3.05 FIELD QUALITY CONTROL

- A. Corrective measures, when necessary, shall be performed as required. The Contractor shall require that the manufacturer of the fireproofing material submit recommendations for corrective measures to the Engineer for approval.
- B. The Contractor shall take frequent, dry film thickness (DFT) readings of applied material to verify compliance with thickness requirements. Measurements shall be taken in accordance with SSPC-PA2, Measurement of Dry Paint Thickness with Magnetic Gages. Submit report of such measurements to the Engineer for record purposes.

END OF SECTION 07 81 24

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Mineral fiber safing insulation.
- B. Silicone foam seal system.
- C. Gypsum fireproofing sealant.
- D. Fire stop sealant.

1.02 SYSTEM DESCRIPTION

- A. System includes specifications for firestopping and fire-resistant penetration seals for floors, walls, ceilings, and roof where fire-rated walls, shafts, or assemblies are penetrated by plumbing, mechanical, and electrical features, or otherwise, as indicated or required.

1.03 MEASUREMENT AND PAYMENT

- A. General: Firestopping will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C475 Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
 - 2. ASTM E119 Test Methods for Fire Tests of Building Construction and Materials
 - 3. ASTM E814 Test Method for Fire Tests of Through-Penetration Fire Stops
- B. Underwriters Laboratories Inc. (UL):
 - 1. Building Materials Directory
 - 2. Fire Resistance Directory
- C. Warnock Hersey (WH):
 - 1. Certification and Listings Directory

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:
 - 1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 7, "Fire-Resistant Materials and Construction."

1.06 QUALITY ASSURANCE

- A. Materials and installation shall meet or exceed the following requirements:
 - 1. UL or WH Classification and Listing.
 - 2. One-hour and two-hour fire ratings when tested in accordance with ASTM E119.
 - 3. Class 1 (25 or less) flame-spread rating when tested in accordance with ASTM E814.

1.07 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit details of firestopping and through-penetration firestopping for indicated installations.
- C. Product Data: Submit product data and installation instructions for indicated applications.

1.08 SITE CONDITIONS

- A. Follow manufacturer's instructions for temperature, ventilation, and other conditions required for proper mixing and installing of foam seals and sealants.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in the manufacturer's original unopened containers or packages with manufacturer's name, labels, product identification, lot numbers, and mixing and installation instructions, as applicable.
- B. Store materials in the original, unopened containers or packages, and under conditions recommended by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Requirements: Fire-stopping materials and fire-resistant penetration seals shall conform with the following types, as applicable for the location:
 - 1. Mineral Fiber: Loose or batt mineral-fiber safig insulation, meeting fire-rating and installation requirements indicated.

2. Foam: One-part or two-part silicone foam, manufactured silicone penetrating seal system, meeting fire-rating and installation requirements indicated.
 - a. Color for exposed locations shall be as selected by the Engineer from manufacturer's standard colors.
 - b. Wherever seals are not exposed to view, provide manufacturer's standard color that has the best overall performance characteristics for the application indicated.
 - c. Associated adhesive sealant, damming materials, and solvent shall be as recommended by the foam manufacturer.
 3. Gypsum Fireproofing Sealant: Trowelable gypsum compound meeting applicable requirements of ASTM C475 and ASTM E814 for one-hour or two-hour fire rating as indicated for the fire-rated assembly being penetrated.
- B. Fire Stop Sealant: Sealant for the sealing of joints packed with mineral fiber or safing insulation shall be fire stop sealant manufactured for the purpose, meeting fire-rating and installation requirements indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine penetrations and openings to be sealed to determine if conditions are satisfactory for the proper installation of fire-resistant materials and seals. If unsatisfactory conditions exist, do not commence work until such conditions have been corrected.
- B. Verify that items and apparatus penetrating openings are installed and completed before beginning the firestop installation.

3.02 LOCATIONS

- A. Provide firestopping and fire-resistant penetration seals wherever required to preserve fire ratings of building elements at plumbing, mechanical, electrical, and other penetrations.

3.03 INSTALLATION

- A. Install materials in clean, dry openings free of loose material and projections.
- B. Install materials in accordance with the respective manufacturer's installation instructions, and as required to provide a tight seal and preserve fire ratings at penetrations and openings.
- C. Inspect foam seals following 24-hour cure; add additional foam as required for tight seal; reinspect and add foam until installation is satisfactory.
- D. Install sealant in accordance with manufacturer's installation instructions.

3.04 CLEANING

FIRESTOPPING

- A. Remove spilled and excess materials adjacent to penetrations without damaging adjacent surfaces.
- B. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

END OF SECTION 07 84 00

SECTION 07 90 00

JOINT PROTECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Sealants.
- B. Primer.
- C. Sealant backing.
- D. Bond breaker.

1.02 SYSTEM DESCRIPTION

- A. The work includes caulking and sealing of joints as required to seal the perimeters of openings in walls, penetrations in walls, expansion and control joints, and as required to weatherproof the station structure and other buildings.
- B. The work includes interior building sealing of joints, penetrations, and openings, including acoustical and sanitary sealing, as indicated and required.

1.03 RELATED SECTIONS

- A. Joint fillers and sealants for concrete slabs and paving are specified in Section 03 15 00 - Concrete Accessories.
- B. Control joints in unit masonry are specified in Section 04 22 00 - Concrete Unit Masonry.
- C. Expansion controls assemblies and covers for major expansion and seismic joints are specified in Section 07 95 00 - Expansion Control.

1.04 MEASUREMENT AND PAYMENT

- A. General: Sealants and caulking will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.05 DEFINITIONS

- A. Sealant and caulking terms specified herein comply with the definitions of ASTM C717.
- B. For the work of this Section, "interior" or "interior locations" are defined as not open to the exterior. Rooms and spaces such as the station concourse and platform are open to the exterior and shall be considered as exterior spaces.

1.06 REFERENCES

- A. American Society for Testing and Materials (ASTM):

JOINT PROTECTION

1. ASTM C717 Standard Terminology of Building Seals and Sealants
 2. ASTM C790 Standard Guide for Use of Latex Sealants
 3. ASTM C834 Specification for Latex Sealants
 4. ASTM C920 Specification for Elastomeric Joint Sealants
 5. ASTM C962 Standard Guide for Use of Elastomeric Joint Sealants
- B. Federal Specifications (FS):
1. TT-S-227 Sealing Compound, Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and other Structures)
 2. TT-S-230 Sealing Compound: Elastomeric Type, Single Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures)
 3. TT-S-1543 Sealing Compound, Silicone Rubber Base (for Caulking, Sealing, and Glazing in Buildings and Other Structures)
- C. Underwriters Laboratories Inc. (UL):
1. UL 1479 Fire Tests of Through-Penetration Firestops

1.07 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Samples: Submit samples of each type of exposed sealant and caulking compound, keyed to the installation location. Provide fully cured samples, 12 inches long, installed between two samples of the materials to be sealed.
- C. Certification: Submit manufacturer's certificate of compliance indicating that each product to be furnished complies with these Specifications, is recommended for the application indicated, and is compatible with the other materials in the joint system.

1.08 QUALITY ASSURANCE

- A. Qualifications: Application/installation of sealant and caulking materials shall be by a licensed applicator skilled and experienced in the application/ installation of sealants and caulking compounds.
- B. Compatibility Tests: Primers and sealants shall be tested by the manufacturer for compatibility and adherence with materials to which application is indicated. Submit test reports certifying compatibility at least 30 days before application.
- C. Field Samples and Mock-Ups:

1. Provide sample application of sealants and caulking compounds at locations approved by the Engineer. Samples shall represent primary types of materials, substrate surfaces, joint size, exposure, and other conditions to be encountered in the work. Preparation, priming, application, and curing shall comply with manufacturer's recommendations for the actual conditions.
2. Samples will be visually examined for staining, dirt pickup, shrinkage, color, work quality, and appearance. Cut and pull sealant from each sample joint to examine for internal bubbles or voids, adhesion, and compatibility with substrate.
3. Schedule applications, with allowance for sufficient curing time, so that samples may be examined and necessary adjustments made at least one week before date scheduled for commencing installation of the work.

1.09 SITE CONDITIONS

- A. Do not proceed with installation of sealants and caulking compounds during inclement weather unless the installation complies with the manufacturer's instructions.
- B. Do not proceed with the installation of sealants under extreme temperature conditions that may cause joint openings to be near either maximum or minimum width, nor when high temperatures or high wind loads are forecast during the period required for initial or nominal cure of elastomeric sealants.
- C. Schedule installation and cure of elastomeric sealants during period of relatively low temperatures (but well within manufacturer's recommended range) so that subsequent tensile stresses upon cured sealants will be minimized.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sealants: Sealants shall be designed for adhesion to the surfaces to which they will be applied, and shall be non-staining, non-shrinking, and non-sagging, meeting the following requirements:
 1. Exterior Sealant: Sealant for exterior locations shall be a silicone or polyurethane elastomeric sealant, as appropriate for the substrate conditions, meeting requirements of ASTM C920, Type S or M, Grade NS, Class 25, and Use designation as required for the location and substrate.
 - a. Silicone Sealant: ASTM C920 and Fed. Spec. TT-S-230 or Fed. Spec. TT-S-1543, as applicable.
 - b. Polyurethane Sealant: ASTM C920 and Fed. Spec. TT-S-227 or Fed. Spec. TT-S-230, as applicable.
 2. Interior Sealant: Sealant for general sealing of interior locations shall be a single-component, gun-grade, paintable, water-base acrylic-latex, meeting requirements of ASTM C834.

3. Acoustical Sealant: Permanently plastic, paintable, synthetic polymer base sealant manufactured specifically for interior acoustical applications.
 4. Sanitary Sealant: Single-component, primerless, flexible, mildew-resistant, silicone rubber, meeting requirements of Fed. Spec. TT-S-1543.
 5. Fire-Resistant Sealant: Sealants used at penetrations of fire-rated walls and ceiling assemblies shall be UL listed as meeting UL 1479.
 6. Sealant for Dielectric Insulation at Platform Edge Units: The electrical resistance of a 6 by 6 inch sample of sealant material shall be a minimum of 500 MΩ when tested with a 1 kV dc tester. Test shall be performed by placing the sample between two 3-by-3 inch copper electrodes. The sample shall be soaked in water 24 hours immediately prior to the test and surface dried prior to testing. Sample thickness shall be 1/2 inch.
 7. Color:
 - a. For fully concealed joints, provide manufacturer's standard color of sealant or caulking compound that has best overall performance characteristics for application indicated.
 - b. For exposed joints, provide color indicated or, if color is not indicated, provide colors as selected by the Engineer from manufacturer's standard colors, to match or blend with adjoining materials or to match adjacent joint material as applicable.
- B. Primer: Primer, when required, shall be a quick-drying, colorless, nonstaining sealer of type and consistency as recommended by the manufacturer of the sealant for the particular type of surfaces to be sealed.
- C. Sealant Backing: Sealant backup or packing (backer rod) shall be a non-absorbent premolded or preformed nonstaining resilient material, such as polyethylene foam rod, or neoprene, butyl, polyurethane, or other closed cell foams or extruded rod, compatible with the sealant used. Follow sealant manufacturer's recommendations for compatibility of backer rod with sealant used. Material shall act as a bond breaker and shall be circular in cross section.
- D. Bond Breaker: When required, pressure-sensitive polyethylene tape, teflon tape, or other plastic tape as recommended by the sealant manufacturer for the location, to prevent bond of sealant in heel of joint.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrate surfaces and joints to be sealed, and conditions under which work is to be performed, and correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

JOINT PROTECTION

- A. Joints and spaces to be sealed or caulked shall be cleaned of dirt, dust, mortar, oil, and other deleterious substances that may impair bond or adversely affect the sealing or caulking work. Where necessary, degrease with an approved solvent or commercial degreasing agent. Surfaces shall be dry before application of sealants or caulking compounds.
- B. Do not apply sealants to joint surfaces previously treated with sealer, curing compound, water repellent, or other coatings, unless a laboratory durability test of bond cohesion has been performed successfully demonstrating that bond will be durable. Test method shall comply with procedures of the ASTM or FS applicable to the particular sealant.
- C. Do not apply paint and other coatings to surfaces adjoining joints until sealants have been installed and are nominally cured.
- D. If recommended by the manufacturer, remove paint and other coatings from surfaces to be sealed prior to sealant application. Remove coatings on metallic surfaces with a solvent that leaves no residue.
- E. Joints shall be cleaned out, full width and depth. Joints shall be raked to proper depth, permitting use of sealant backing and sealant of indicated depth. Depth of joint in back of sealant shall be filled with sealant backing as specified. Sealant shall not be applied without sealant backing material, unless indicated otherwise on the Contract Drawings.
- F. Joints shall be enclosed on three sides. Where grooves for adequate sealing have not been provided, suitable grooves shall be cleaned out to depth required or as indicated and cut or ground to minimum width of 1/4 inch without damage to adjoining work. Minor variations in width shall not require correction. Damaged adjacent or connecting work resulting from cutting or grinding shall be restored.

3.03 INSTALLATION/APPLICATION

- A. Surface preparation of joints, application of primers, installation of sealant backing and bond breaker, and installation of sealant shall be in accordance with the sealant manufacturers' installation instructions and recommendations and the requirements of ASTM C790 and ASTM C962, as applicable.
- B. Thickness of sealant shall be one-half the joint width, with a minimum thickness of 1/4 inch. Sealant shall bond the two opposing surfaces of the joint.
- C. Seal joints continuously with sealant around openings in exterior walls, at control and expansion joints, and at other locations indicated or required for waterproofing the building or structure. Seal and caulk joints as indicated and as required to complete the building or structure, both exterior and interior.
- D. Joints shall be filled to within specified depth from the surface with sealant backing, and the remainder of joint shall then be filled with sealant as specified. Sealant shall be forced into joints mechanically, with sufficient pressure to expel all air and provide a solid filling against the sides of joint and the sealant backing or bond breaker material.
- E. Sealant shall be placed before painting operations are started. Sealant in joints adjacent to painted work shall be placed before final coat of paint is applied.

JOINT PROTECTION

- F. Sealant shall be applied when ambient temperature is between 45 degrees and 90 degrees F and when weather conditions are favorable for sealing operations.
- G. Joints receiving sealant shall have sealant backing material with diameter greater than joint width, solidly placed and properly aligned, permitting pressure-applied sealant to be of uniform thickness, positively stopped, and assuring that sealant presses firmly against joint edges for adequate bonding.
- H. Concrete, masonry, stucco, and other surfaces, if recommended by the sealant manufacturer, shall be primed before applying sealant. Primer shall be applied with a brush that will reach all parts of joints to be filled with sealant.
- I. Sealant in joints shall be tooled flat or slightly concave. Joints in back of applied trim shall be caulked and inspected before trim is permanently installed. Sealed and caulked joints shall be neatly pointed on flush surfaces with beading tool, and internal corners with eaving tool. Excess material shall be cleanly removed.
- J. Finished sealed and caulked surfaces shall be uniformly smooth and free from wrinkles and air holes.

3.04 CURING AND PROTECTION

- A. Cure compounds and sealants in accordance with manufacturer's instructions to obtain maximum bond to surfaces, and cohesive strength and durability at earliest possible date.
- B. Provide for protection of sealants and caulking compounds during remainder of construction period, so that they will be without deterioration or damage at time of acceptance of the work.

3.05 FIELD QUALITY CONTROL

- A. Perform inspections necessary to assure proper preparation of locations and joints to receive sealants and caulking and to assure compliance with manufacturer's instructions for mixing, installation, curing, and protection.
- B. After curing of exterior joints exposed to weather, test for leaks by applying a stream of water perpendicular to the surface from a 1/2-inch or 5/8-inch hose at normal city water pressure. Test at least ten percent of the exposed joint system.
- C. Repair leaks and retest as directed.

3.06 CLEANING

- A. Confine compounds to joint areas indicated by use of masking tapes or other precautions to prevent spillage or migration onto adjoining surfaces. Remove excess compound or sealant promptly as work progresses and clean adjoining surfaces to eliminate evidence of spillage.

END OF SECTION 07 90 00

SECTION 07 95 00

EXPANSION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Expansion joint assemblies.
- B. Fire-rated joint cover assemblies.

1.02 RELATED SECTIONS

- A. Expansion and isolation joint fillers and sealants for concrete slabs and paving are specified in Section 03 15 00 - Concrete Accessories.
- B. Control joints for unit masonry are specified in Section 04 22 00 - Concrete Unit Masonry.
- C. Expansion joints in roofing are specified in the individual roofing sections under Division 7, Thermal and Moisture Protection, as applicable.
- D. Sealants for sealing of perimeter joints at openings in walls and for joints at abutting materials are specified in Section 07 90 00 - Joint Protection.
- E. Control and expansion joints for portland cement plaster are specified in Section 09 24 11 - Portland Cement Plaster.

1.03 MEASUREMENT AND PAYMENT

- A. Measurement: Expansion control devices will be measured for payment by the lump-sum method, acceptably fabricated and installed.
- B. Payment: Expansion control devices will be paid for at the indicated Contract lump-sum price as indicated in the Bid Schedule of the Bid Form.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM A240 Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
 2. ASTM A480 Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
 3. ASTM B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 4. ASTM C509 Specification for Elastomeric Cellular Preformed Gasket and Sealing Material

EXPANSION CONTROL

5. ASTM C834 Specification for Latex Sealants
6. ASTM C864 Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
7. ASTM C920 Specification for Elastomeric Joint Sealants
8. ASTM C1085 Specification for Butyl Rubber-Based Solvent-Release Sealants
9. ASTM E119 Test Methods for Fire Tests of Building Construction & Materials
10. ASTM E814 Test Method for Fire Tests of Through-Penetration Fire Stops
11. ASTM F738 Specification for Stainless Steel Metric Bolts, Screws, and Studs

B. Underwriters Laboratories Inc. (UL):

1. Building Materials Directory
2. Fire Resistance Directory

C. Warnock Hersey (WH):

1. Certification and Listings Directory

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data and Shop Drawings: Submit manufacturers' product data of vertical and horizontal expansion-joint closures, assemblies, seals, and sealants for review. Include installation details.
- C. Fire Rating Certification: Submit copies of UL Classification or Warnock Hersey Listing for fire-rated joint covers.

PART 2 - PRODUCTS

2.01 EXPANSION JOINT ASSEMBLIES

- A. Expansion joint closures and seals shall be aluminum extrusions and neoprene or silicone rubber seals of type and size to suit the construction as indicated.
- B. Materials and requirements include the following:

1. Aluminum Retainers and Cover Plates: Aluminum alloy meeting requirements of ASTM B221, alloy 6063-T5, anodized, of configuration and size as indicated or recommend by the expansion-control system manufacturer.
2. Visual Seals: Dense neoprene or dense silicone synthetic rubber conforming with ASTM C864, of 70 durometer hardness, plus or minus 5.
3. Functional Seal: Closed cell neoprene synthetic rubber conforming with ASTM C509, medium density.
4. Corner Angles: Stainless steel conforming to ASTM A240 and ASTM A480, Type 304 or 316.
5. Fasteners: Stainless steel conforming to ASTM F738 or equivalent, Type 316 or equivalent 300 Series (18-8) stainless steel.
6. Sealant: Sealant for installation behind aluminum retainer, in rear pocket of aluminum retainer, and at joints, where indicated, shall conform to ASTM C834, C920, or C1085 as appropriate for the construction and exposure conditions.

2.02 FIRE-RATED JOINT COVER ASSEMBLIES

- A. Requirements: Fire-rated joint covers shall have been tested in accordance with ASTM E119 and ASTM E814, including hose stream test at full rated period. Covers shall be classified by Underwriters Laboratories or listed by Warnock Hersey, or equal. Minimum fire rating shall be two hours, but not less than rating of adjacent construction. Materials shall be inorganic and shall not create smoke or contribute fuel during a fire.
 1. All metal components and cover plates shall be 300 Series (18-8) stainless steel with No. 4 finish. Aluminum is not acceptable.
- B. Fire Barrier: Fabricated of layers of ceramic fiber insulation and metallic insulation.
- C. Flame Sealant: Sealant shall remain resilient to permit joint movement and shall, upon exposure to heat, increase in volume to resist penetration of fire through voids in construction.
- D. Fireproofing: Of type required by fire rating; asbestos is not acceptable.
- E. Fire-Rated Joint Covers: Fire barrier and flame sealant shall provide required fire rating.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Expansion Joint Assemblies: Install expansion-joint assemblies and engineered floor and wall seals as indicated and in accordance with the approved Shop Drawings and the manufacturer's installation instructions and recommendations.

EXPANSION CONTROL

- B. Fire-Rated Joint Assemblies: Install as required to meet fire-rated design and construction. Install fire barriers and flame sealant as required to complete the installation and meet fire-rating requirements.

END OF SECTION 07 95 00

5.8 Division 8

Openings

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SECTION 08 01 57

WINDOW RESTORATION AND REPLACEMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Windows.
- B. Glass and glazing.
- C. Sealants.
- D. Electrolytic bituminous isolation coating.
- E. Anchorage devices and fasteners.

1.02 RELATED DOCUMENTS

- A. Aluminum windows are specified in Section 08 51 16 -Aluminum Windows.
- B. Glass and glazing are specified in Section 08 80 00 - Glazing.
- C. The station or building involved in this work will be in continuous operation during the construction period. This will require that the Contractor plan the work carefully to work around unavoidable obstacles. It will require further that the Contractor complete some new construction facilities required in the renovation work before proceeding with the window restoration and replacement work.
- D. Provide such additional temporary facilities as may be required to facilitate continuous, unobstructed station or building operation during transitional construction work.

1.03 MEASUREMENT AND PAYMENT

- A. General: Restoration and replacement of existing windows will not be measured separately for payment, but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.04 REFERENCES

- A. Comply with the Referenced Standards specified in Section 08 51 16 - Aluminum Windows, and Section 08 80 00 - Glazing, as applicable to the window restoration and replacement work.

1.05 REGULATORY REQUIREMENTS

- A. Comply with the Regulatory Requirements specified in Section 08 51 16 – Aluminum Windows, and Section 08 80 00 - Glazing, as applicable to the window restoration and replacement work.

1.06 SUBMITTALS

- A. Provide submittals in accordance with the requirements of Section 08 51 16 - Aluminum Windows, and Section 08 80 00 - Glazing, as applicable to the window restoration and replacement work, for the Engineer's review.

1.07 QUALITY ASSURANCE

- A. Window restoration and replacement work shall conform with the installation instructions and recommendations of the manufacturer of the windows to be provided for this work.
- B. Quality assurance for the window restoration and replacement work shall conform with the quality assurance requirements of Section 08 51 16 – Aluminum Windows, and Section 08 80 00 – Glazing, as applicable.

1.08 WARRANTY

- A. Comply with the warranty requirements of Section 08 51 16 - Aluminum Windows.

PART 2 – PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. Requirements: Provide all materials, equipment, tools, appurtenances, facilities, and services as required for performing and completing the window restoration and replacement work as indicated.
- B. Windows:
 - 1. Windows shall be monumental, operable and fixed sash aluminum windows, as indicated, conforming with applicable requirements of Section 08 51 16 - Aluminum Windows.
 - 2. Windows shall be fully glazed insulated-glass units, as indicated, furnished complete with continuous moldings and glazing stops, frames, finish window hardware, and all anchors, fasteners, and accessories as required for a complete and finished, operable installation.
 - 3. Finish for windows shall be a full 70 percent polyvinylidene fluoride finish conforming with requirements of AAMA 2604. Color: as selected by the Engineer from manufacturer's standards.
 - 4. Window units and operable vents shall be fully weatherstripped in accordance with the manufacturer's standards.
- C. Glass and Glazing: Factory glaze sash with clear float, insulating glass as specified in Section 08 80 00 - Glazing. Units shall be "wet" glazed" with snap-in aluminum extruded glazing bead and PVC bulb on the interior of the glass. Exterior glass shall be set in a continuous bead of silicone sealant. Provide for expansion and contraction of acoustical glass.

- D. Sealants: Refer to Section 07 90 00 - Joint Protection, for requirements.
- E. Electrolytic Bituminous Isolation Coating: Asphalt- or coal-tar pitch-based paint or varnish of heavy or thick consistency, or 1/16-inch thick neoprene or butyl tape.
- F. Anchorage Devices and Fasteners: Tempered aluminum or 30 Series stainless steel when exposed; cadmium- or zinc-plated when concealed.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. After careful removal of existing windows, examine existing framed window openings for damaged and defective framing. Damaged or defective framing shall be repaired or replaced as required to provide substantial framed substrate surfaces conducive to the installation of new windows and related flashings.
- B. Where aluminum is installed in contact with dissimilar metals, concrete, masonry, or stucco, the aluminum shall be painted with bituminous isolation coating or separated with neoprene or butyl tape.
- C. Aluminum surfaces to be in contact with sealants shall be cleaned with solvent.

3.02 INSTALLATION OF NEW WINDOWS

- A. New windows shall be installed in accordance with Section 08 51 16 - Aluminum Windows, as applicable to the work of this Section.
- B. All work shall be performed and completed as required to obtain the required warranties specified in Section 08 51 16 - Aluminum Windows.

3.03 REHABILITATION OF EXISTING WINDOWS

- A. Rehabilitate existing windows to like new condition. Operable vents shall operate smoothly and effortlessly under normal opening and closing pressures. Lubricate as required. Operable vents shall be watertight in closed position.
- B. Cracked and broken glass shall be replaced, and shall conform with applicable requirements of CCR Title 24, Part 6, California Energy Code.
- C. Repainting of existing windows shall conform with applicable requirements of Section 09 91 00 - Painting. Color and sheen shall be as selected by the Engineer.

3.04 ADJUSTING

- A. Comply with the adjusting requirements of Section 08 51 16 - Aluminum Windows.

3.05 CLEANING

- A. Comply with the cleaning requirements of Section 08 51 16 - Aluminum Windows, and Section 08 80 00 - Glazing.

END OF SECTION 08 01 57

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal doors.
- B. Lights and vision panels.
- C. Louvers.
- D. Fire-rated doors.
- E. Acoustical doors.
- F. Metal frames.
- G. Door seals and weatherstripping.
- H. Door silencers.

1.02 MEASUREMENT AND PAYMENT

- A. General: Steel Doors and Frames will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A123.1 Nomenclature for Steel Doors and Steel Door Frames
 - 2. ANSI A224.1 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
 - 3. ANSI A250.5 Accelerated Physical Endurance Test Procedure for Steel Doors, Frames, and Frame Anchors
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM E90 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
 - 2. ASTM E152 Methods of Fire Tests of Door Assemblies
- C. Door & Hardware Institute (DHI):
 - 1. DHI A115 Series for Steel Door Preparation Standards

D. National Fire Protection Association (NFPA):

1. NFPA 80 Fire Doors and Windows

E. Steel Door Institute (SDI):

1. SDI 100 Recommended Specifications for Standard Steel Doors and Frames
2. SDI 105 Recommended Erection Instructions for Steel Frames
3. SDI 107 Door Hardware on Steel Doors (Reinforcement-Application)
4. SDI 110 Standard Steel Doors and Frames for Modular Masonry Construction
5. SDI 111 Recommended Standard Details, Steel Doors and Frames
6. SDI 114 Test Procedure and Acceptance Criteria for Acoustical Performance for Steel Door and Frame Assemblies
7. SDI 117 Manufacturing Tolerances, Standard Steel Doors and Frames
8. SDI 118 Basic Fire Door Requirements

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures. For Shop Drawings and other submittals, employ terms as specified in ANSI A123.1.
- B. Shop Drawings: Submit Shop Drawings for hollow metal doors and frames showing size, location, and elevation of each metal door and frame, gage and type of material, details for fabrication of each door and frame, including size and location of each mortise, penetration, reinforcement, sound seal, light, louver, and anchoring device. Indicate the quantity of each size and type of door and frame. Comply with applicable requirements of SDI 100 and SDI 111 Series Drawings.
- C. Product Data: Submit manufacturer's product data of each type of door and frame and certification that materials meet Specification requirements.
- D. Reports and Certificates:
 1. Submit certified test reports from an independent testing laboratory of sound transmission class (STC) ratings for acoustical door assemblies.
 2. Submit certificates of inspection as required for fire-rated doors.

1.05 QUALITY ASSURANCE

- A. Manufacturing Standards: Comply with applicable requirements of SDI 100.
- B. Manufacturing Tolerances: Comply with applicable requirements of DHI A115 and SDI 117.
- C. Fire-Rated Doors and Frames: Comply with applicable requirements of DHI A115, SDI 100, and SDI 118. Classification shall be based on door-and-frame assemblies tested in accordance with ASTM E152.
- D. Acoustical Doors and Frames: Comply applicable requirements of DHI A115, SDI 100 and SDI 114. Sound transmission class (STC) ratings shall be based on door-and-frame assemblies tested in accordance with ASTM E90.

PART 2 - PRODUCTS

2.01 DOORS

- A. Classification: Grade and model shall conform with SDI 100 as follows:
 1. Doors for Public Use: Grade III - Extra Heavy Duty, Model 2, Seamless, hollow steel construction, internally reinforced with minimum 22 gage continuous vertical formed steel sections spanning the full thickness of the interior space between door faces, securely attached to face sheets by spot welds spaced maximum 5-inches on center. Minimum face gage shall be 16-gage. Spaces between internal stiffeners shall be filled to full height of door with chemically inert, noncombustible moisture-resistant mineral fiber. Sizes and thicknesses as indicated. Doors shall be fabricated from Type 304 stainless steel. Surfaces exposed to view shall be polished to a number 4 satin finish.
 2. Doors for District Personnel Use Only: Grade II-Heavy-Duty, Model 1 or 2, full flush type, hollow steel or composite construction, of sizes and thicknesses indicated.
- B. Doors shall be prepared and reinforced for installation of hardware in accordance with DHI A A115 and SDI 107.
- C. Lights and Vision Panels: Comply with glazing requirements of SDI 100. Provide for glazing with synthetic rubber gaskets. Coordinate with Section 08 80 00 - Glazing. Glass shall not contact metal.
- D. Louvers: Comply with louvered-door requirements of SDI 100 and SDI 111. Provide Inverted "V" Blade, "Z" Blade, or Inverted "Y" Blade inserted louvers as indicated, complete with frame and moldings. For exterior doors, provide "Z" Blade or Inverted "Y" Blade louvers. For fire-rated doors, provide Fusible Link louvers in accordance with requirements of SDI 111 and SDI 118. Louvers shall be a minimum of 16 gage cold rolled steel. All louvers shall be vandal proof with pinned stainless steel flat head security screws and single sided mounting for stainless steel doors. Provide stainless steel louvers for stainless steel doors.
- E. Fire-Rated Doors: Where indicated to be fire doors (fire-rated), or where class of opening requires fire door, provide fire doors and frames in accordance with requirements of DHI A115, SDI 100 and SDI 118, of full flush type (Model 1 or 2). Provide each door with label of Underwriters Laboratories Inc. (UL) or Warnock Hersey (WH) for class of opening as indicated in accordance with SDI 118. Labels shall be metal, fastened to hinge stile edge of door.

- F. Acoustical Doors: Provide acoustical doors where indicated of full flush type in accordance with DHI A115 and SDI 100. Provide door and frame assembly with sound transmission class (STC) rating as indicated when tested in accordance with SDI 114. Door and frame units shall be complete with necessary seals and rubber gasketing to achieve the rating.

2.02 FRAMES

- A. Frames shall be hollow pressed-steel frames, combination buck, frame, and trim type as indicated, welded frames, conforming to SDI 100. Corners shall be mitered, fully welded, and ground smooth. Integral stops (rabbets) shall be not less than 5/8 inch in depth.
- B. Frames shall be prepared and reinforced for installation of hardware in accordance with DHI A A115 and SDI 107. Steel for frames shall be not lighter than 16 gage. For openings wider than 6 feet, provide 14 gage steel.
- C. Frames for openings in masonry walls shall conform with applicable requirements of SDI 110.
- D. Frames for fire-rated doors and openings shall conform with requirements of DHI A115, SDI 100 and SDI 118 for class of opening indicated. Provide each fire-rated frame with UL or WH label for class of opening, or submit proof of conformance with UL or WH labeling requirements for approval.
- E. Frames for stainless steel doors shall be stainless steel having same finish as doors.

2.03 SHOP FINISH

- A. Doors and frames shall be treated for paint adherence and given a baked-on corrosion-inhibitive prime coat of metallic oxide or synthetic resin primer in accordance with SDI 100 and meeting acceptance criteria of ANSI A224.1.
- B. Finish field painting is specified in Section 09 91 00 - Painting.

2.04 DOOR SEALS AND WEATHERSTRIPPING

- A. Doors and frames shall be fitted with door seals or gaskets where indicated, and exterior doors and frames shall be fitted with applied rain drips and weatherstripping on all four sides (entire perimeter of opening) in accordance with applicable requirements of SDI 111.
- B. Weatherstripping and seals shall be non-ferrous, with synthetic rubber edge seals where indicated or required, of type or style appropriate for the purpose. Drips and visible weatherstripping shall be painted out to match doors and frames.
- C. Door seals or gasketing for fire-rated doors and acoustical doors shall be synthetic rubber of type manufactured and appropriate for the purpose.
- D. Coordinate types and scheduling of door seals and weatherstripping with Contract Specifications 08 71 00 - Door Hardware, and the types of thresholds to be furnished.

2.05 DOOR SILENCERS

- A. Provide pneumatic rubber silencers for interior doors, except fire-rated doors. Coordinate with Section 08 71 00 - Door Hardware. Provide as follows:
1. Single-Leaf Doors: Three each lock jamb frame.
 2. Double-Leaf Doors: Two each leaf at head frame, plus three each on astragal.
- B. Silencers shall be installed in stops of frames.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Installation Standards: Install door frames and doors in accordance with SDI 100 and SDI 105, meeting the performance and acceptance criteria of ANSI A250.5. Door frames and doors installed in masonry walls shall meet the requirements of SDI 100 and SDI 110.
- B. Frames: Frames shall be set accurately in position, plumbed, aligned, and braced securely until permanent anchors are installed. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to structure above, as required. Where indicated or required by class of opening, frames shall be filled solid with portland cement grout by providing one inch grout holes at top of each door jamb. Provide additional grout holes as required to fill around internal obstructions.
- C. Doors: Doors shall be hung by skilled workers to fit snug against stops. Fit accurately and hang free from hinge bind with uniform clearance of 3/32 inch at heads and jambs. After hanging, make adjustments, and then remove doors and hardware for finish painting and make final adjustments. Verify that direction of swing is as indicated.
- D. Finish Hardware: Coordinate installation with Contract Specifications Section 08 71 00 - Door Hardware.
1. Install accurately and securely without marking or defacing hardware or finish work. Hardware shall be fastened with machine screws or bolts. Sheet metal screws will not be permitted. Test hardware to assure correct alignment and operation. Finish hardware shall be fastened at all points where fasteners are indicated or required.
 2. Thresholds shall be embedded in approved sealant, and shall be secured to concrete floors with stainless steel screws in nonferrous expansion shields.
 3. Provide hardware in satisfactory working order. Clean and polish.
- E. Door Seals and Weatherstripping: Weatherstripping and seals shall be installed to provide rainproof service and so that there is no air, light, and sound leakage. Stops shall fit tight against doors.
- F. Fire-Rated Doors and Frames: Installation of doors and frames, including hardware and operational characteristics, shall be in accordance with NFPA Standard No. 80, as applicable. Verify that doors and frames are labeled as indicated.

METAL DOORS AND FRAMES

- G. Prime Paint Touch-Up: Immediately after installation, touch up damaged prime coat with the same primer as was used for the shop finish. Lightly sand and feather out damaged surfaces so that paint touch-up becomes invisible. Spray paint touch-up work.
- H. Temporary Protection: Provide protective facings or coverings for doors and frames to receive continued use during construction.

END OF SECTION 08 11 00

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Access doors for concrete and masonry construction.
- B. Access doors for plaster construction.
- C. Access doors for gypsum board construction.
- D. Access doors for ceramic tile surfaces.
- E. Access doors for floors.
- F. Access hatches at station platforms.
- G. Access hatch smoke vent.

1.02 DESCRIPTION

- A. Furnishing and installing access doors and hatches in finished surfaces to provide access to mechanical, electrical, and piping control devices concealed behind finished surfaces as indicated and required.
- B. Concealed work, to which access must be available to personnel after completion, shall have appropriate access doors and frames as specified herein furnished and installed by the Contractor.
- C. Locations shall be suitable for access required and shall be approved by the Engineer before installation. Access panels shall be compatible with the construction in which they are installed, and installation shall be complete with required hardware, grounds, screeds, attachment devices, and trim.
- D. Coordinate with the Facility Services Section requirements.

1.03 MEASUREMENT AND PAYMENT

- A. General: Access doors and panels will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 2. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B. National Association of Architectural Metal Manufacturers (NAAMM):

1. NAAMM AMP 503 Finishes for Stainless Steel

C. Underwriters Laboratories Inc. (UL):

1. UL Building Materials Directory

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirement and procedures.

B. Shop Drawings and Product Data: Submit Shop Drawings and manufacturer's product data of each different type of access door and panel proposed to be furnished, including the locations of each. Include installation details appropriate for the type of construction into those doors and panels will be installed.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Where access is required in one-hour or two-hour fire-rated walls or partitions, floors or ceilings, provide access door assembly of type and manufacture listed in the UL Building Materials Directory. Provide UL or equivalent label on each fire-rated access door assembly.

B. Templates and Setting Instructions: Provide complete information, diagrams, templates, and installation instructions as required for access doors and panels provided herein, and in sufficient time so that backing and framing can be properly installed, and so that work of other trades will not be delayed.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide access door or panel as a single integral unit with frame, anchors, hardware, accessory parts, fittings and fastenings. Units shall be the standard products of the manufacturer, modified as necessary to meet requirements.

B. Where size of door or panel is not indicated, furnish 9 inches by 12 inches size for hand access or 24 inches by 24 inches size where body access is necessary.

2.02 ACCESS DOORS FOR CONCRETE AND MASONRY CONSTRUCTION

A. Door: Full flush design of 18 gage mild steel, double pan, fully welded, encapsulating 2 inches of rigid insulation.

B. Frame: 16 gage mild steel with joints fully welded and ground smooth.

- C. Anchors: Corrugated steel or similar steel anchors for concrete and masonry construction, galvanized.
- D. Hinge: Continuous with stainless steel pin that permits opening door to 175 degrees.
- E. Closer: Spring, torque, or tension.
- F. Lock: Flush, key-operated to accept District's designated CAT 74 key, spring-loaded latch and interior release.
- G. Finish: Phosphate-treated and prime painted, manufacturer's standard.
- H. Fire-Rating Label: UL 1-1/2 hour "B" label.

2.03 ACCESS DOORS FOR PLASTER CONSTRUCTION

- A. Door: Full flush design of 18 gage mild steel, double pan, fully welded, encapsulating 2 inches of rigid insulation.
- B. Frame: 16 gage fully welded mild steel with a 1-inch deep plaster ground on 3 inches wide expanded metal lath.
- C. Anchors: No. 10-32 FHMS to steel studs at 12 inches on center.
- D. Hinge: Continuous with stainless steel pin which permits opening door to 175 degrees.
- E. Closer: Spring, torque, or tension.
- F. Lock: Flush, key-operated to accept District's designated CAT 74 key, spring-loaded latch and interior release.
- G. Finish: Phosphate-treated and prime painted, manufacturer's standard.
- H. Fire-Rating Label: UL 1-1/2 hour "B" label.

2.04 ACCESS DOORS FOR GYPSUM BOARD CONSTRUCTION

- A. Door: Single sheet of 14 gage galvanized mild steel sheet.
- B. Frame: 16 gage galvanized mild steel with drywall bead.
- C. Anchors: Self-drilling, self-tapping screws to steel studs at 8 inches on center.
- D. Hinges: Concealed spring-loaded that permits opening door to 175 degrees.
- E. Lock: Flush, key-operated to accept District's designated CAT 74 key, spring-loaded latch and interior release.
- F. Finish: Phosphate-treated and prime painted, manufacturer's standard.

2.05 ACCESS DOORS FOR CERAMIC TILE SURFACES

- A. Door: Single sheet of 14 or 16 gage, Type 304 stainless steel sheet meeting requirements of ASTM A167.
- B. Frame: 16 gage stainless steel with fully welded joints ground smooth.
- C. Anchors: Self-drilling, self-tapping screws to steel studs at 8 inches on center.
- D. Hinges: Concealed spring-loaded that permits opening door to 175 degrees.
- E. Lock: Flush, key-operated to accept District's designated CAT 74 key, spring-loaded latch and interior release.
- F. Finish: Satin (NAAMM AMP 503 No. 4 finish).

2.06 ACCESS DOORS FOR FLOORS

- A. Door: Diamond or checkered pattern, 1/4-inch thick steel plate minimum, designed for live load of 300 pounds per square foot.
- B. Frame: Integral gutter-frame of 1/4-inch steel plate with a continuous anchor flange. Equip gutter with 1-1/2 inch coupling for drainage connection.
- C. Hinges: Heavy forged brass with stainless steel pins.
- D. Control: Coil spring opening assist and closing retarder. Provide hold open arm that becomes engaged when the door reaches its fully open position. Provide hold open release handle.
- E. Lock: Spring-loaded stainless steel latch with interior handle and removable exterior wrench. Provide two interior slide bolts on inactive leaf of pair of doors.
- F. Finish: Galvanized after fabrication in accordance with ASTM A123.
- G. Safety Chain: Provide safety chain on inactive side of pair of open doors.

2.07 ACCESS HATCHES AT STATION PLATFORMS

- A. Pan Type Door: Fabricated from minimum 3/16-inch thick Type 304 or Type 316 stainless steel plate with stainless steel angle frame meeting requirements of ASTM A167, designed for live load of 300 pounds per square foot.
- B. Frame: Type 304 or Type 316 stainless steel angle frame anchored in concrete.
- C. Hinges: Heavy forged brass with stainless steel pins.
- D. Control: Coil spring opening assist and closing retarder. Provide hold open arm that becomes engaged when the door reaches its fully open position. Provide hold open release handle.

- E. Lock: Spring-loaded stainless steel latch with interior handle and removable exterior wrench. Provide two interior slide bolts on inactive leaf of pair of doors. Lock to be operable from below at all times.
- F. Finish: At top edges of frame and pan, provide NAAMM AMP 503, No. 4 finish.
- G. Epoxy adhesive: Refer to Section 03 30 00 - Cast-in-Place Concrete, for requirements.
- H. Safety Chain: Provide safety chain on inactive side of pair of open doors.

2.08 ACCESS HATCH SMOKE VENT

- A. Single Leaf Door: Provide door fabricated from minimum 14 gage hot-dip galvanized steel cover, complete with 1-inch insulation protected by metal liner, neoprene draft seal, and inside handle.
- B. Curb: Provide metal curb fabricated from 14 gage hot-dip galvanized steel, complete with counterflashing and one-inch insulation outside. Curb shall be 12 inches high, formed with 3-1/2-inch roof flange anchored in concrete.
- C. Hardware: Provide smoke vent equipped with spring hinges, hydraulic shock absorbers, shubber springs, and spring latch with Underwriters Laboratories approved 160-degree F fusible link. All hardware shall be zinc-plated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Access doors and panels shall be installed as indicated and in accordance with the approved Shop Drawings and the manufacturer's installation instructions and recommendations. Finished installations shall be square and true, plumb and level, as required, and flush with surrounding surfaces. In tile walls, align edges with tile joints.
- B. Coordinate the locations of access doors and panels with the Engineer and receive approval from the Engineer for exact locations before doing any installation work. Coordinate the installation of access doors and panels with the trades in whose finishes the doors and panels will be installed. See that appropriate finish materials are installed in recesses of door panels as required to match surrounding adjacent surfaces.
- C. Access doors and panels required for plumbing, mechanical, and electrical equipment and items requiring access, in other Sections when applicable, shall be installed under this Section in accordance with the approved Shop Drawings, and the manufacturer's installation instructions and recommendations, and as required to complete the work.

END OF SECTION 08 31 00

BART Facilities Standards (BFS)

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SECTION 08 33 13

COILING COUNTER DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roll-up (coiling) counter doors.

1.02 MEASUREMENT AND PAYMENT

- A. General: Overhead coiling counter doors will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings and Product Data: Submit Shop Drawings and manufacturer's product data of roll-up counter doors, including materials, finishes, details of installation, associated accessories, and locking hardware.
- C. O & M Manual: Submit operation and maintenance manual in accordance with the requirements of Section 01 78 23 - Operation and Maintenance Data.

1.05 QUALITY ASSURANCE

- A. Provide the services of a manufacturer's representative, experienced in the installation, operation, and maintenance of overhead coiling counter doors of the type specified, for technical assistance and advice during installation and testing.

PART 2 - PRODUCTS

2.01 ROLL-UP (COILING) COUNTER DOORS

- A. Type and Manufacture: Roll-up counter doors shall be complete, factory-fabricated door and frame assemblies, manufactured of 300 Series stainless steel, hand push-up or crank operated, mounted within the provided opening as indicated. Doors shall be counter-balanced for smooth and easy operation.
- B. Door Components:
 - 1. Curtain: Interlocking slats, flat slat design, manufactured from ASTM A167 Series 300

stainless steel, minimum 22 gage. Size and style of slat shall be as selected by the Engineer from manufacturer's standards.

2. Guides: 300-Series stainless-steel box guides.
3. Footpiece: 300-Series stainless-steel tubular section with rubber bumper and with two recessed pulls for hand push-up operated doors.
4. Hood: Minimum 24 gage 300 Series stainless steel.
5. Weatherstripping: Wool pile at jambs for weatherproofing, dust protection, and to eliminate metal-to-metal contact.
6. Security Hardware: Concealed slide bolt operated by thumb knob from interior side only.
7. Fasteners: 300 Series stainless steel.
8. Operation: Hand push-up operation for doors up to 4 feet 6 inches in width, and hand crank operation for doors more than 4 feet 6 inches in width.
9. Gears: Cast iron, with gear ratio designed for maximum 30-pound manual effort.
10. Counterbalancing: Adjustable oil-tempered torsion springs capable of counterbalancing weight of curtain; with barrel sized to limit deflection to 0.03 inch per foot.
11. Finish: No. 4 polished satin finish for exposed stainless steel surfaces.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install roll-up (coiling) counter doors in accordance with the manufacturer's installation instructions and the approved Shop Drawings.
- B. Test, adjust, and service the door assembly as required for proper operation.

3.02 COMPLETION

- A. At completion, the counter door assembly shall be square, plumb, and level, accurately aligned, and securely anchored to the supporting structure.
- B. Roll-up counter doors shall operate smoothly, quietly, and free from binding, with the footpiece striking sill surface uniformly for its entire length.
- C. Exposed surfaces of assembly shall be clean and free from scratches, dents, tool marks, stains, discoloration, and other defects and damage.
- D. At completion, lubricate moving parts as required for a smooth and quiet operation. Clean and polish all exposed surfaces.

COILING COUNTER DOORS

END OF SECTION 08 33 13

BART Facilities Standards (BFS)

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SECTION 08 33 19

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roll-up (coiling) steel service doors.
- B. Power operating equipment.

1.02 RELATED SECTIONS

- A. Finish field painting is specified in Section 09 91 00 - Painting.
- B. Electrical service conduit and wiring, disconnect switches, and overcurrent protection are included in applicable Electrical Sections.

1.03 MEASUREMENT AND PAYMENT

- A. General: Overhead coiling doors will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirement and procedures.
- B. Shop Drawings and Product Data: Submit detailed Shop Drawings and manufacturer's product data of overhead coiling doors, including installation details and wiring diagrams.
- C. Operation and Maintenance Data:
 - 1. Submit operation and maintenance data in accordance with requirements of Section 01 78 23 - Operation and Maintenance Data.
 - 2. Submit recommended spare parts list, together with parts' numbers and prices, and photographs or cuts of repair parts.
 - 3. Submit operation and maintenance manual containing printed instructions relative to operation, adjustment, care, and maintenance of the equipment. Include wiring diagrams showing field changes, if any.

1.05 QUALITY ASSURANCE

- A. Provide the services of a manufacturer's representative, experienced in the installation, operation, and maintenance of overhead coiling doors of the type specified, for technical assistance and advice during installation and testing.

1.06 SPARE PARTS

- A. Provide one set of critical spare parts for each door, boxed and identified, including installation instructions, wiring diagrams, and other information as necessary to make emergency repairs.

PART 2 - PRODUCTS**2.01 ROLL-UP (COILING) DOORS**

- A. Type and Manufacture: Roll-up (coiling) steel service doors shall be motor-operated, steel roll-up type, face-mounted as indicated. Doors shall be counter-balanced for smooth and easy operation.
- B. Design Criteria: Doors shall be designed and manufactured to be fully operable under a wind load of 20 pounds per square foot.
- C. Curtain: Door curtain shall consist of interlocking slats fabricated from minimum No. 20 gage, or heavier if required by size of door or fire-rating class, hot-dipped galvanized copper bearing strip steel. Galvanizing shall be in accordance with ASTM Standards with not less than 1.25 ounces per square foot of slat material. Prepare for painting with phosphate treatment standard with the manufacturer. Bottom edge of curtain shall be reinforced with two angles back to back. Style of slats shall be flat and rectangular as selected by the Engineer from manufacturer's standards.
- D. Weather Seal: Weather seal shall be a compressible weatherseal mounted along the bottom edge of the door. Color of sealing strip shall be white.
- E. Guides: Guides shall be of standard rolled steel angles or channels, as required, not less than 3/16-inch thick and of sufficient size to retain curtain in guides at a wind pressure of 20 pounds per square foot. Include all anchors, fasteners, and accessories as required to properly prepare door opening for installation of the guides.
- F. Brackets: Brackets shall be of fabricated mild steel plate, bolted to wall angles that extend continuously from the floor to the top of the curtain brackets. Each wall angle shall in turn be secured to the wall with not less than five 1/2-inch standard bolts or anchors as applicable.
- G. Barrel: Barrel shall house an oil-tempered helical counterbalance spring and be of sufficient size to prevent deflection of over 0.03 inch per foot of opening span. Shaft bearings in barrel and bracket shall be roller bearing thoroughly lubricated to require no further attention.
- H. Hood: Hood shall be formed to fit the contour of the brackets and shall be fabricated of not less than 24 gage galvanized steel. Hood shall be continuous one piece over the full length of overhead door except at motor. Motor hood shall be a one piece hood connected to the overhead door hood. Motor hood shall have access panels where necessary.
- I. Weatherstripping: Hood shall have a hinged baffle of neoprene and galvanized sheet metal so positioned that it will form an effective draft stop when the door is in the closed position. Jambs shall be weatherstripped with continuous end lock, and shall have a continuous bronze strip with webbing.

- J. Finish: Finish shall consist of one factory-applied, manufacturer's standard shop coat of rust-inhibitive metal primer before shipment.

2.02 POWER OPERATING EQUIPMENT

- A. Roll-up (coiling) doors shall be motor-operated. All equipment and accessories necessary for the proper operation of doors shall be furnished and installed. Motors shall be electric hoist-type, high-starting torque, providing sufficient power to operate doors at approximately one foot per second without shock.
- B. Provide prewired power operator with operating components preconnected to terminal strips within control box to facilitate field connection to power source and push-button operating station.
- C. Furnish and install an operating station for the remote control and operation of each door at locations indicated. Stations shall be constant pressure type. Stations in non-public areas shall be push-button-type with "Open" and "Close" positions. Stations in public accessible areas shall be key switched. Key cylinder shall be furnished under Section 08 71 00 - Door Hardware.
- D. Electric operator (motor) shall be fully automatic, furnished complete with pushbutton controls or key switch as hereinbefore specified and limit switch.
- E. All doors shall have over-ride manual operating capability. An emergency hand crank operator shall be provided to operate the door in case of power failure or removal of motor for inspection or servicing. The motor disengaging shall be accomplished by an eye hook using the hand crank.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Roll-up (coiling) steel service doors shall be installed by the manufacturer or its authorized representative, employing only workers and mechanics skilled and experienced in the installation of the type of work involved. Doors shall be installed as indicated and in accordance with the approved Shop Drawings and the manufacturer's installation instructions and recommendations.
- B. After installation is complete, the Contractor shall demonstrate to the District that the doors operate properly in accordance with the manufacturer's specifications and recommendations.
- C. Verify that operating controls, manual controls, bypass and safety devices are operating properly.
- D. The Contractor shall instruct District personnel in the operation of the doors.

3.02 MAINTENANCE

- A. The Contractor shall provide call-back maintenance service for a period of one year, beginning from the date of Acceptance of the Work.

END OF SECTION 08 33 19

SECTION 08 33 23

OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roll-up (coiling) grilles.
- B. Power operating equipment.

1.02 RELATED SECTIONS

- A. Electrical service conduit and wiring, disconnect switches, and overcurrent protection are included in applicable Electrical Sections.

1.03 MEASUREMENT AND PAYMENT

- A. General: Overhead coiling grilles will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings and Product Data: Submit detailed Shop Drawings and manufacturer's product data of overhead coiling grilles, including installation details and wiring diagrams.
- C. Operation and Maintenance Data:
 - 1. Submit operation and maintenance data in accordance with requirements of Section 01 78 23 - Operation and Maintenance Data.
 - 2. Submit recommended spare parts list, together with parts' numbers and prices, and photographs or cuts of repair parts.
 - 3. Submit operation and maintenance manual containing printed instructions relative to operation, adjustment, care, and maintenance of the equipment. Include wiring diagrams showing field changes, if any.

1.05 QUALITY ASSURANCE

- A. Provide the services of a manufacturer's representative, experienced in the installation, operation, and maintenance of overhead coiling grilles of the type specified, for technical assistance and advice during installation and testing.

1.06 SPARE PARTS

- A. Provide one set of critical spare parts for each grille, boxed and identified, including installation instructions, wiring diagrams, and other information as necessary to make emergency repairs.

PART 2 - PRODUCTS**2.01 ROLL-UP (COILING) GRILLES**

- A. Type and Manufacture: Roll-up (coiling) grilles shall be motor-operated, 300-Series stainless-steel roll-up type grille, face-mounted or mounted within the opening as indicated. Grilles shall be counter-balanced for smooth and easy operation.
- B. Curtain: Grille curtain shall consist of 5/16-inch diameter horizontal stainless steel rods at 1-1/2 inches on center, connected by 1/8-inch by 3/4-inch stainless steel links at 9 inches on center, connected to and between double links in a straight pattern, assembled to prevent horizontal movement of the links. Connect ends of horizontal rods with a continuous link assembly and end locks to prevent lateral movement of the curtain and to retain the horizontal bars in the guides. Bottom Rail: Stainless steel tube, 2 inch by 4 inch by 1/8 inch thick.
- C. Curtain Guides: 300-Series stainless-steel clad aluminum extrusion with retainers for end locks, replaceable wear strips each side of curtain groove, and removable bell mouths.
- D. Mounting Brackets: Rolled steel plate designed to support the weight of the curtain along with its operating devices, resist the thrust of operation, and act as a closure for the hood.
- E. Barrel: Seamless steel pipe, 4 inches or larger in diameter, designed to rotate about the torsion rod on permanently lubricated and sealed, self-aligning, ball-bearing races, with deflection limited to 0.03 inch per foot when fully loaded with weight of curtain. Provide rings about the barrel, shaped to permit nesting of the curtain. Secure these rings to barrel at 4 inches from each edge of the curtain and at not more than 8 feet on center between.
- F. Counterbalance: Oil-tempered, helically-wound springs, stress-relieved after coiling, attached at one end to the barrel through a cast iron anchor and to the torsion rod at its other end by a similar device. Counterbalance shall provide support of curtain as required to permit operation with not more than 50 pounds pull on the operating device.
- G. Torsion Rod: High-tensile, case-hardened carbon steel, sufficiently long to penetrate the balancing springs, anchors, bearings, and torsion adjustment wheel. Adjustment wheel shall be outside the mounting bracket and accessible at all times.
- H. Hood: Manufacturer's standard configuration for face mounting or head mounting within the frame, as indicated, minimum 24 gage galvanized steel. Hood shall be continuous one piece over the full length of overhead grille except at motor. Motor hood shall be a one piece hood connected to the overhead grille hood. Motor hood shall have access panels where necessary.

2.02 POWER OPERATING EQUIPMENT

- A. Roll-up (coiling) grilles shall be motor-operated. All equipment and accessories necessary for the proper operation of grilles shall be furnished and installed. Motors shall be electric hoist

type, high starting torque, providing sufficient power to operate grille curtain at approximately one foot per second without shock.

- B. Provide prewired power operator with operating components preconnected to terminal strips within control box to facilitate field connection to power source and operating station.
- C. Provide an operating station for the remote control and operation of each grille curtain at locations indicated. Provide key operated maintained pressure type with "Open" and "Close" positions. Provide key cylinder specified in Section 08 71 00 - Door Hardware.
- D. Roll-up (coiling) grilles shall be furnished complete with seal as hereinbefore specified.
- E. Electric operator (motor) shall be fully automatic, furnished complete with key switch controls as hereinbefore specified and limit switch.
- F. All security grilles shall have over-ride manual operating capability. An emergency hand crank operator, that does not affect the timing of the limit switch, shall be provided to operate the grille curtain in case of power failure or removal of motor for inspection or servicing. The motor disengaging shall be accomplished by an eye hook using the hand crank.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that size and configuration of openings to receive overhead coiling security grilles complies with indicated details and approved Shop Drawings.
- B. Furnish templates and install anchoring devices for coiling grilles in adjacent supporting structure as required.

3.02 INSTALLATION

- A. Roll-up (coiling) grilles shall be installed by the manufacturer or its authorized representative as indicated and in accordance with the approved Shop Drawings and the manufacturer's installation instructions and recommendations, employing only workers and mechanics skilled and experienced in the installation of the type of work involved.
- B. After installation is complete, the Contractor shall demonstrate to the Engineer that the security grilles operate in accordance with the manufacturer's specifications and recommendations.
- C. The Contractor shall instruct District personnel in the operation of the security grilles.

3.03 PERFORMANCE TESTS

- A. Perform electrical and manual operation of the security grille, including activating safety interlocks, under the observation of the Engineer, to ensure that grille curtain is free of obstructions and operates smoothly through its full range of travel in both directions.
- B. Verify that operating controls, manual controls, bypass and safety devices are operating properly.

3.04 MAINTENANCE

- A. The Contractor shall provide call-back maintenance service for a period of one year, beginning from the date of acceptance of this work by the District.

END OF SECTION 08 33 23

SECTION 08 51 16

ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Aluminum windows.
- B. Baked finish.
- C. Hardware.
- D. Weatherstripping.
- E. Glass and glazing.
- F. Anchoring devices and fasteners.
- G. Electrolytic bituminous isolation coating.
- H. Sealants.

1.02 RELATED SECTIONS

- A. Glass and glazing are specified in Contract Specifications Section 08 80 00 - Glazing.
- B. Restoration and replacement of existing windows are specified in Contract Specifications Section 08 01 57 - Window Restoration and Replacement.

1.03 MEASUREMENT AND PAYMENT

- A. General: Aluminum windows will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. ANSI/AAMA 101 Voluntary Specifications for Aluminum and Poly (Vinyl Chloride)(PVC) Prime Windows and Sliding Glass Doors
 - 2. AAMA 2604 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels
 - 3. AAMA 1503.1 Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections
- B. American Society for Testing and Materials (ASTM):

1. ASTM B221 Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
2. ASTM E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors
3. ASTM E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
4. ASTM E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing codes:
1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 24, "Glass and Glazing", and Appendix Chapter 13, "Energy Conservation in New Building Construction."
 2. California Code of Regulations (CCR), Title 24, Part 6, California Energy Code, applicable requirements.

1.06 QUALITY ASSURANCE

- A. Test Units:
1. Air, water, and structural test unit sizes and configuration shall conform with requirements of ANSI/AAMA 101.
 2. Thermal test unit sizes shall be 4 feet by 6 feet. Unit shall consist of a single typical vent.
- B. Test Procedures and Performance: Windows shall conform to ANSI/AAMA 101 requirements for the window types specified. In addition, windows shall meet the following performance requirements:
1. Air Infiltration Test:
 - a. With window sash and ventilators closed and locked, test unit in accordance with ASTM E283 at static air pressure difference of 6.24 pounds per square foot.
 - b. Air infiltration shall not exceed 10 cubic feet per minute per foot of perimeter crack length.
 2. Water Resistance Test:

- a. With window sash and ventilators closed and locked, test unit in accordance with ASTM E331 at static air pressure difference of 7.50 pounds per square foot.
 - b. There shall be no uncontrolled water leakage.
3. Uniform Load Structural Test:
- a. With window sash and ventilators closed and locked, test unit in accordance with ASTM E330 at a static air pressure difference of 80 pounds per square foot positive pressure and 80 pounds per square foot negative pressure.
 - b. At conclusion of the test, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms, or actuating mechanisms, nor any other damage that would cause the window to be inoperable or otherwise defective.
4. Condensation Resistance Test (CRF):
- a. With window sash and ventilators closed and locked, test unit in accordance with AAMA 1503.1.
 - b. Condensation resistance factor shall be not less than 51.
5. Thermal Transmittance Test (Conductive U-value):
- a. With window sash and ventilators closed and locked, test unit in accordance with AAMA 1503.1.
 - b. Conductive thermal transmittance (U-value) shall be not more than 60 BTU per hour per degree F per square foot.
- C. Drainage: Window design shall enable water entering or occurring within the system to drain to the exterior.

1.07 SUBMITTALS

- A. General: Refer to Contract Specification Sections 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Show materials, sizes and shapes of members, details of fabrication and installation, and finish hardware.
- C. Product Data: Submit window manufacturer's product data, including illustrative photos (catalog cuts) of the windows, operating and locking hardware, and color chart for selection of coating color.

- D. Samples: 3 feet by 4 feet sample of operable unit, of materials, finish and color specified; sample shall include polycarbonate glass, glazing, and hardware.
- E. Test Reports: Test reports from AAMA accredited laboratories certifying specified performance. Furnish with specified certification.
- F. Certification: AAMA Notice of Certification stating that the tested window meets or exceeds referenced criteria for ANSI/AAMA 101 window type specified.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Contract Specifications Section 01 60 00 - Product Requirements, for general requirements for delivery, storage, and handling procedures.
- B. Do not allow windows or components to come in contact with mud, uncured concrete, materials that with the presence of moisture could cause staining of finish, and other materials that could damage windows or their finish.

1.09 WARRANTY

- A. In addition to the guaranty requirements of the General Conditions, Article GC4.9, Guaranty of Work, furnish warranties specified below in a form acceptable to the Engineer. The warranty shall begin when the Guaranty of Work begins as specified in General Conditions Article GC4.9.
- B. Total Window System:
 - 1. Contractor shall warrant for three years the satisfactory performance of the total window installation, including windows, hardware, glass, glazing, anchorage and setting system, sealing, flashing, and associated items as it relates to air, water, and structural adequacy as specified and as indicated on approved Shop Drawings.
 - 2. Deficiencies due to such elements not meeting specified requirements shall be corrected at Contractor's expense during the warranty period.
- C. Finish Coating: Warrant finish fluoropolymer coating for five years for film integrity, and against color fade and chalking.

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

- A. Window Type: Monumental operable and fixed sash aluminum windows, as indicated, meeting requirements of ANSI/AAMA 101, with baked fluoropolymer finish.

- B. Aluminum: ASTM B221, 6063-T5 alloy and temper, extrusions of sizes indicated and of thickness required to meet specified design and performance requirements.
1. Extrusions:
 - a. Minimum wall thickness shall be 0.125 inches.
 - b. Depth of frame and sash shall be 2 7/16-inches minimum.
 2. Frame Components: Mitered, reinforced with aluminum angle, and welded.
 3. Sash:
 - a. Extrusions shall be tubular.
 - b. Each corner shall be mitered, reinforced with an extruded aluminum corner key, hydraulically crimped, and "cold-welded" with epoxy adhesive.
 - c. Each operable sash shall have two rows of neoprene weatherstripping installed in specially designed dovetail grooves in sash extrusion.
 4. Internal Components: Manufacturer's standard stainless steel or other corrosion-resistant materials compatible with aluminum extrusions.
- C. Baked Fluoropolymer Finish: Full 70 percent polyvinylidene fluoride finish. Only coatings based on fluoropolymer resins meeting requirements of AAMA 2604, will be accepted. Color shall be as selected and approved by the Engineer from manufacturer's standards. All exposed aluminum surfaces shall receive the baked fluoropolymer finish.
- D. Hardware:
1. Operating Handles: Locking handles shall be cam type manufactured from white bronze alloy with a US25D brushed finish. Furnish Allen keyed custodial lock and concealed limit stop.
 2. Operating Arms: Pivot vents shall be extruded aluminum pivot housing with stainless steel pin.
- E. Weatherstripping: Neoprene, for use between frame and vent.
- F. Glass and Glazing: Factory glaze sash with clear float, insulating glass as specified in Contract Specifications Section 08 80 00 - Glazing. Units shall be "wet glazed" with snap-in aluminum extruded glazing bead and PVC bulb on the interior of the glass. Exterior of glass shall be set in a continuous bead of silicone sealant. Provide for expansion and contraction of acoustical glass.
- G. Anchoring Devices and Fasteners: Aluminum or stainless steel when exposed, cadmium- or zinc-plated steel when concealed.

- H. Electrolytic Bituminous Isolation Coating: Asphalt- or Coal-tar pitch-based paint or varnish of heavy or thick consistency, or 1/16-inch thick neoprene or butyl tape.
- I. Sealants: Refer to Contract Specifications Section 07 90 00 - Joint Protection, for requirements.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Where aluminum is installed in contact with dissimilar metals, concrete, or masonry, the aluminum shall be painted with bituminous isolation coating or separated with neoprene or butyl tape.
- B. Clean aluminum surfaces that will come in contact with sealants.

3.02 INSTALLATION

- A. Install windows as indicated and in accordance with approved shop drawing, and the window manufacturer's installation instructions and recommendations.
- B. Plumb and align window faces in a single plane for each wall plane, and install windows square and true, adequately anchored to maintain positions permanently when subjected to normal thermal and building movement and specified wind loads.
- C. Calk and seal windows completely around their perimeters with sealant and tape as required.

3.03 ADJUSTING

- A. Adjust ventilators and associated hardware to operate smoothly, to provide a tight fit at contact points and weatherstripping, and to meet specified performance requirements. Following adjustment, leave operable units in closed position.
- B. Apply sealants at joints and intersections and at opening perimeters. Wipe off excess material and leave exposed surfaces and joints clean and smooth.
- C. Upon completion of installation, windows shall be inspected, adjusted, and operable units put into proper working order to operate smoothly.
- D. All units shall be weathertight as specified.

3.04 CLEANING

- A. Clean exterior and interior faces of windows free of labels, dirt, and other adhering foreign materials, using cleaning materials and methods recommended by the window and glass manufacturers.

END OF SECTION 08 51 16

SECTION 08 63 00

METAL-FRAMED SKYLIGHTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal framed roof skylight.
- B. Baked enamel finish.
- C. Glass.
- D. Glazing gaskets.
- E. Fasteners and accessories.
- F. Isolation coating.
- G. Sealant.

1.02 MEASUREMENT AND PAYMENT

- A. General: Metal-framed skylights will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 605.2 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels
 - 2. AAMA 1600 Voluntary Specifications for Skylights
 - 3. AAMA SDGS-1 Structural Design Guidelines for Aluminum Framed Skylights
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM E283 Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- C. Federal Specifications (FS):
 - 1. TT-S-230 Sealing Compound: Elastomeric Type, Single Component, Chemically Curing (for Calking, Sealing, and Glazing in Buildings and Other Structures)
 - 2. TT-S-1543 Sealing Compound: Silicone Rubber Base (for Calking, Sealing, and Glazing in Buildings and Other Structures)

1.04 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:

California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 15, "Roofing and Roof Structures," and Chapter 24, Section 2409, "Sloped Glazing and Skylights."

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings and Product Data: Submit detailed Shop Drawings and manufacturer's product data of the roof skylight, giving sizes, details of fabrication and construction, glass data, coatings data, color chart, method of assembly, locations and types of anchors, and related work.
- C. Samples: Submit samples of lengths of coated metal framing, in color as selected. Color-coated metal surfaces require approval of the Engineer.

1.06 DESIGN AND QUALITY ASSURANCE

- A. Conform with requirements of the California Building Code, Chapters 15 and 24, AAMA 1600, and AAMA SDGS-1, as applicable.
- B. Design and Responsibility: Roof skylight shall be designed, fabricated, and installed by a skilled and experienced supplier/installer specializing in the design, manufacture, and installation of custom skylights.
- C. Design Criteria: Comply with the hereinbefore specified Reference Standards and the following:
1. Structural Design Requirements: California Building Code, Chapters 15 and 24; maximum deflection: 1/240.
 2. Live Load: 40 pounds per square foot.
 3. Wind Loads: 30 pounds per square foot, (positive and negative).
 4. Seismic Design: Calculations of seismic loading and design for seismic conditions shall be in accordance with the California Building Code, Chapter 16 and Chapter 16A, Division IV – Earthquake Design.
 5. Thermal Movement: Provide for noiseless expansion and contraction that may be caused by a temperature range of 100 degrees F.
 6. Weathertight Integrity:
 - a. Water Penetration: None.

- b. Air Infiltration: Maximum of 0.06 cubic foot per minute when tested in accordance with ASTM E283.

7. Glass Safety Factor: 2.5.

1.07 GUARANTY

- A. In addition to the guaranty requirements specified in the General Conditions, Article GC4.9, roof skylight and related flashings shall be guaranteed against leakage, defective materials, and poor work quality of the completed work. Any such defects or leakage occurring during the period of the guaranty shall be promptly and completely corrected, including all affected work, at no additional cost to the District.
- B. Said guaranty shall be in effect for a period of five years from the date of Certificate of Substantial Completion issued by the District. The guaranty shall be signed by the skylight installer and countersigned by the Contractor, and shall be submitted to the Engineer prior to acceptance of the skylight work.
- C. In addition, submit coating system manufacturer's standard 20 year warranty for the fluoropolymer baked-enamel finish as herein specified.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Skylight Type: Skylight shall be custom-designed and -fabricated, metal-framed roof skylight, conforming with the details and dimensions indicated.
- B. Baked-Enamel Finish:
 - 1. Coating System: Exposed metal framing shall be coated and finished with a baked fluoropolymer enamel coating system. Color shall be a standard color as selected and approved by the Engineer from manufacturer's standards.
 - a. Heads of exposed fasteners shall be coated to match color of adjacent baked enamel finish.
 - 2. Coating Performance: Final coating shall conform with the ASTM performance and test requirements specified in AAMA 605.2.
- C. Glass: Comply with requirements indicated and the California Building Code, Chapter 24, Glass and Glazing.
- D. Glazing Gaskets: Extruded synthetic rubber, continuous glazing gaskets, tape, or strip, as recommended by the skylight manufacturer.
- E. Fasteners and Accessories: Furnish anchors and fasteners, washers, straps, and accessories required for a complete and finished installation. Fasteners connecting framing members and fasteners exposed to weather shall be Type 304 or Type 316 stainless steel. Interior fasteners

shall be stainless steel with heads coated to match baked-enamel finish. Fasteners shall have rubber gaskets or washers under heads, nuts, and metal washers.

- F. Isolation Coating: Framing members to be in contact with concrete, wood, plaster, or dissimilar metals shall be painted with a heavy coat of alkali-resistant bituminous paint.
- G. Sealant: Silicone synthetic rubber elastomeric sealant that cures at normal temperature to a flexible firm rubber, tack free, and designed for adhesion to the surfaces to which it will be applied. Sealant shall meet or exceed the minimum requirements of Fed. Spec. TT-S-230 or Fed. Spec. TT-S-1543, as applicable.

2.02 FABRICATION

- A. Roof skylight shall be custom designed and fabricated to suit building conditions and roof opening, of sizes and configurations indicated.
- B. Sizes and design characteristics of the framing members shall be as required by opening spans to carry a minimum live load of 40 pounds per square foot with a maximum fiber stress of 13,000 pounds per square inch and maximum deflection of 1/240 at center of span and as specified in Article 1.05.C.
- C. Metal framing shall be prefabricated and preassembled in the factory or shop as far as practicable. Welding shall be performed in the shop by qualified welders as specified in Section 05 05 22 - Metal Welding. Welds exposed to view shall be ground and dressed smooth.
- D. Provide for expansion and contraction in the fabrication and assembly of metal framing.
- E. Provide for drainage of condensation to the exterior. Curbs shall be provided with condensation weep holes.
- F. Glass shall be continuously supported on glazing gaskets or tape at all bearing surfaces, top and bottom. Gaskets or tape shall be compressed a minimum of 15 percent all around to form a tight seal. There shall be no glass surfaces bearing on metal. Gaskets and sealing tape shall be continuous and shall seal glass and metal watertight. Provide for 5/8-inch minimum grip of glass and for expansion and contraction of glass.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Skylight shall be installed and glazed by the manufacturer or its authorized representative as indicated and in accordance with the approved Shop Drawings and the manufacturer's installation instructions and recommendations, using only workers skilled and experienced in this type of work.
- B. Ample provisions shall be made in flashings and assemblies for expansion and contraction. Skylight shall be watertight after installation and completion of the work.
- C. Skylight assembly shall be set on curb in continuous bead of sealant. Skylight assembly and flashings shall be calked and sealed with sealant as required for a watertight installation.

METAL-FRAMED SKYLIGHTS

Calking and sealing work shall conform with applicable requirements of Section 07 90 00 - Joint Protection.

3.02 TESTS

- A. Skylight installation shall be watertight, and water tests to prove this shall be conducted by the Contractor, under the observation of the Engineer. Water tests shall be performed in conjunction with roofing water tests. Tests shall be performed before work is started on interior finishes.

END OF SECTION 08 63 00

BART Facilities Standards (BFS)

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SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Door hardware.
- B. Public safety key box.
- C. Coordination of interfaces among security and access control equipment, door hardware, doors, and frames.

1.02 MEASUREMENT AND PAYMENT

- A. General: Door hardware will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCE STANDARDS

- A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
 - 1. ANSI/BHMA 156 Standards Set
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 80 Standard for Fire Doors and Fire Windows

1.04 DESIGN REQUIREMENTS

- A. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.
- B. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA 80. This requirement takes precedence over other requirements for such hardware. Provide only such hardware which has been tested and listed by a nationally recognized testing laboratory for the type and size of door required, and complies with the requirements of the door and the door frame labels. Latching hardware, door closers, ball bearing hinges, and seals are required for fire-rated openings whether or not listed in the hardware schedule.
 - 1. Provide hardware listed by nationally recognized testing laboratory for labeled and 20-minute openings in conformance with requirements for class of opening scheduled. Provide label or stamp of nationally recognized testing laboratory on hardware for labeled openings.
 - 2. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door's testing laboratory label on exit device indicating "Fire Exit Hardware."

- C. Furnish all items of hardware required to complete the work in accordance with Contract Documents. Provide all items required for a complete functional operation and code compliance at each door opening. Items not specifically mentioned but necessary to complete the work shall be furnished, matching in quality and finish the item specified for similar locations.
- D. Provide hardware with suitable fasteners for complete work.
- E. Quantities listed are for the Contractor's convenience; confirm quantities.
- F. If the grade of an item designated by ANSI/BHMA designation is not indicated, provide Grade 1.
- G. Hand of Door: Contract Drawings show direction of swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Coordinate submittal of door hardware with submittals of related items including metal doors and frames and electrified components to be integrated with doors.
- C. Submit door hardware schedule organized into "Hardware Sets" with an index of doors and heading indicating complete designations of every item required for each door or opening. Include the following information:
 - 1. Type, style, function, size, quantity, and finish of each hardware item.
 - 2. Name, part number, and manufacturer of each item.
 - 3. Fastenings and other pertinent information.
 - 4. Location of hardware set cross-referenced to indications on Contract Drawings both on floor plans and in door schedule.
 - 5. Explanation of abbreviations, symbols, and codes contained in schedule.
 - 6. Mounting locations including heights for hardware.
 - 7. Door and frame sizes and materials.
- D. Wiring Diagrams: Submit wiring diagrams, if applicable, tailored for each applicable opening including electric hardware, security equipment, and access control equipment. Indicate and coordinate with door and frame rough-ins required.
- E. Product Data:
 - 1. Manufacturers' technical data and installation instructions.
 - 2. Catalog cuts, marked to indicate applicable item.

- F. Samples: If requested by the Engineer, submit one sample of each type of hardware. Samples will be returned, and approved samples may be used in the work.
- G. Templates: Where required, furnish hardware templates to each fabricator of doors, frames, and other work to be factory-prepared for the installation of hardware.
- H. Keying Schedule: Submit separate detailed schedule indicating clearly how the Engineer's final instructions on keying of locks has been fulfilled.
- I. Supplier's AHC Inspection: Submit report and written statement signed by the AHC that its inspection has been completed as specified under the Article entitled "Adjusting" herein.
- J. Operation and Maintenance Manual: Submit in accordance with Section 01 78 23, Operation and Maintenance Data. Include record "as installed" copy of final hardware schedule. Include "as installed" wiring diagrams for each piece of hardware connected to power.

1.06 QUALITY ASSURANCE

- A. Supplier Qualifications: Firm with three years experience in distribution of commercial/institutional hardware who has in its employ a certified architectural hardware consultant (AHC) who is available at reasonable times during the course of the Work for consultation to the Engineer and Contractor. AHC shall be responsible for scheduling and coordinating hardware and establishing keying schedule.
- B. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from only one manufacturer.
- C. Keying Schedule Meeting: Conduct keying meeting with the Engineer, hardware supplier, AHC, and other District representatives. Review functionality, keying, and programming of locksets and locking hardware. Provide copies of proposed keying and programming schedule for use at the meeting.
- D. Security Hardware Coordination: For doors with electrical and electronic interfaces conduct the following coordination:
 - 1. Conduct a detailed shop drawing review working session (Working Session) to coordinate security system, door hardware, doors and frames, and associated conduits, wiring, and power provisions.
 - a. Participants shall include the Contractor, the Engineer, AHC, and representatives of the various subcontractors and suppliers involved in the supply and installation of the work being coordinated. Schedule and hold meeting within 120 days following the Notice to Proceed.
 - 2. Submit one copy of each related security, door hardware, and door and frame submittals a minimum of seven days prior to Working Session for preliminary review.
 - 3. In Case of Incomplete Submittal:

DOOR HARDWARE

- a. If the Engineer notifies the Contractor that the submittals are incomplete, the Contractor shall postpone and reschedule the Working Session for a date no later than 30 days from the date of notification.
 - b. Correct deficiencies in submittals and repeat the submittal of one copy of each of the related submittals for preliminary review a minimum of seven days prior to Working Session. (Process shall continue until the Engineer deems that the submittals are sufficiently complete for the Working Session.)
4. Working Session Submittal: The Contractor shall compile all comments and changes discussed in the Working Session into a Working Session Submittal and submit this document along with the required number of sets of the corrected submittals (related security, door hardware, and door and frame submittals).
 5. Conduct additional Working Sessions and submittal review cycles if determined necessary by the Engineer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at the Site: Deliver products in original unopened packaging with legible manufacturer's identification. Individually package each unit of finish hardware complete with proper fastening and appurtenances, clearly marked on the outside to indicate contents and specific locations in the Work. Include installation instructions. Mark hardware to correspond with approved hardware schedule.
- B. Deliver packaged hardware items at the times and to the locations (shop or field) for installation, as appropriate and in accordance with the progress schedules.

1.08 PROJECT CONDITIONS

- A. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function.
- B. Verify that doors and entrances will incorporate adequate provisions for the proper installation of hardware.

1.09 WARRANTY

- A. Provide manufacturers' guarantees as follows:
 1. Closers, Except Electronic Closers: Ten years.
 2. Electronic Closers: Two years.
 3. Exit Devices and Locksets: Three years
 4. All Other Hardware: Two years.

1.10 DISTRICT INSTRUCTION

- A. Instruct District personnel in operation and maintenance of hardware units. Refer to Section 01 79 00, Demonstration and Training.

1.11 MAINTENANCE MATERIALS

- A. Provide wrenches and tools furnished by manufacturers as required for proper maintenance of hardware. Clearly label wrenches and tools. Provide two sets of such wrenches and tools to the Engineer.

PART 2 - PRODUCTS**2.01 PRODUCTS**

- A. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade names displayed in a visible location (omit removable nameplates), except in conjunction with required UL or FM labels and as otherwise approved by the Engineer.
 - 1. Manufacturer's identification will be permitted on rim of lock cylinders only.
- B. Hinges: Outswinging exterior doors and doors which swing out from an employee only or private area into a public area or corridor shall have non-removable pin hinges. Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Hinges shall be non-rising. Furnish hinges with five knuckles and flush bearing.
 - 1. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
 - 2. Provide hinges as listed in schedule.
- C. Locksets and Cylinders
 - 1. Locksets and cylinders shall be Designated Matching Products specified in Contract Specifications Section 08 71 00, Door Hardware. Locksets shall be "0" bitted, 7 pin, G keyway, A626 finish, 630 seat, standard core.
 - 2. Lockset Backset: 2-3/4 inches.
- D. Strikes: Provide lockset manufacturer's standard wrought box strike for each latch or lock bolt, with extended lips to protect frame, finish to match hardware set.
 - 1. Provide flat lip strikes for locks with 3-piece, anti-friction latchbolts as recommended by manufacturer.
 - 2. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.
 - 3. Provide roller type strikes where recommended by manufacturer of the latch and lock units.

DOOR HARDWARE

- E. Exit Devices: ANSI/BHMA 156.3, Grade 1. Trim of exits to match trim of locksets, unless specified otherwise. No aluminum devices will be allowed. Stainless steel finish.
- F. Surface Door Closers: ANSI/BHMA 156.4, Grade 1. Heavy-duty arms and knuckles. Full rack and pinion type with removable non-ferrous cover, 1 1/2 inch minimum bore. Place closers inside building, stairs, and rooms. Provide appropriate closer type so that closers are not visible to public view.
 - 1. Closers shall be non-handed, non-sized, adjustable, and multi-size 1 through 6.
 - 2. Drop brackets are required at narrow head rails.
 - 3. Set exterior doors closers to have 8.5 lbs maximum pressure to open, interior non-rated at 5 lbs, rated openings at 12 lbs.
 - 4. Separate adjusting valves for closing and latching speed, and backcheck.
- G. Kickplates: Provide with four beveled edges, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish pan-head countersunk screws to match finish.
- H. Screws: All exposed screws shall be Phillips head.
- I. Silencers: Furnished under Section 08 11 00, Metal Doors and Frames. Omit where seals occur.
- J. Stops: Provide stops for swing doors. Provide heavy-duty wall stops with concave rubber bumpers. Whenever wall stops are not practical use dome style heavy-duty floor stops. In instances where neither a wall nor door stop is practical, provide closer with a 90-degree swing with increased back-check.
- K. Thresholds: Provide thresholds in single length for each opening with ends scribed or shaped to seat snugly against jamb profiles.
- L. Weatherstripping and Seals:
 - 1. Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf: heads, jambs, and astragals of doors.
 - 2. Seals: Seals shall be finished to match adjacent frame color as approved by the Engineer. Material shall be listed by a nationally recognized testing laboratory for labeled openings.
 - 3. Replaceable Seal Strips: Provide only those units where resilient or flexible silicone seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
 - 4. Weatherstripping:
 - a. At jambs and heads, provide bumper-type resilient insert with an retainer strips, surface applied.
 - b. At astragals, provide a compression bulb resilient pressure sensitive door gasketing.

- 5. Door Bottoms: Provide handed, surface mounted units with sponge neoprene seal.
- M. Door Bolts: Provide flush bolts at tops and bottoms of inactive leaf of each pair of doors, with minimum of 1/2 inch diameter rods.
- N. Public Safety Key Box: Provide a public safety key box of extra heavy-duty vault construction with re-locking and drill-resistant door, recessed mounted unless otherwise indicated. Finish as specified in the Contract Specifications Section 08 71 00, Door Hardware, in accordance with local Fire Department requirements.

2.02 FINISH

- A. Typical Finish: BHMA 630 satin stainless steel, unless otherwise noted.
- B. Protection Plates, Push, Pulls, Exit Devices, Locksets and Mortise Locks: BHMA 630 satin stainless steel, unless otherwise noted.
- C. Door Closer Finish: Factory power coat to match other hardware, unless otherwise noted.

2.03 KEYING REQUIREMENTS

- A. Provide construction cores and keys during the construction period. Construction keys shall be "0" bitted keys. Construction control and operating keys and core shall not be part of the District's permanent keying system or furnished on the same keyway (or key section) as the District's permanent keying system.
- B. Contractor shall notify the Engineer in writing a minimum of two weeks prior to occupancy to allow enough time to schedule re-keying of the permanent cores which will be performed by the District locksmith.
- C. Permanent keys and cores shall be stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Furnish key blanks in the following quantities:
 - 1. 4 each Masterkeys blanks per lock.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Electrified Hardware: For cable termination to electrified hardware, provide coordination so that cable is routed to door from transfer hinge to lockset, prior to buttoning up.

- C. Install hardware using fasteners provided by the respective manufacturer suitable for application. Drill and tap screw holes in metallic materials.

3.02 HARDWARE LOCATIONS

- A. Hinges:
 - 1. Bottom Hinge: 10 inches from door bottom to bottom of hinge.
 - 2. Top Hinge: 5 inches from door top to top of hinge.
 - 3. Center Hinge: Center between top and bottom hinge.
 - 4. Extra Hinge: 6 inches from bottom of top hinge to top of extra hinge.
- B. Lock: 38 inches from finished floor to center of lever or knob.
- C. Push Bar: 44 inches from bottom of door to center of bar.
- D. Push Plate: 44 inches from bottom of door to center of plate.
- E. Pull Plate: 42 inches from bottom of door to center of pull.
- F. Exit Device: 39-13/16 inches from finished floor to center of pad.
- G. Deadlock Strike: 44 inches from floor, centered.

3.03 ADJUSTING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.
- B. Manufacturer/Distributor's Field Services: After installation is complete, provide the services of hardware supplier's AHC for an inspection. AHC shall inspect completed door openings to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final approved submittals. Further adjust hardware as necessary during inspection. Perform inspection in the presence of the Engineer and District maintenance personnel.
 - 1. Check closers to ensure proper operation.
 - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 - 3. Report findings, in writing, outlining corrective actions and recommendations.

DOOR HARDWARE

- C. Final Adjustment: Whenever hardware installation is made more than one month prior to Revenue Service or occupancy of a space or area, as applicable, return to work during the week prior to Revenue Service or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for operation of heating and ventilating equipment.
1. For door closers, provide final adjustment of door closers to ensure that all doors close and latch properly to prevent false door held alarms or intrusions and compliance with maximum opening pressure.
 - a. Adjust closer to complete full closing cycle in less than 4 to 6 seconds without abrupt change of speed between "sweep" and "latch" speeds.
 - b. Adjust "back-check" according to manufacturer's instructions.
 2. Power Up and Test: Provide powered up testing of doors in the presence of the installer of electrified hardware, as applicable, to ensure final adjustments to electrified components.
 3. During final adjustment of hardware, instruct District personnel in proper adjustment and maintenance of hardware and hardware finishes. This training shall be coordinated with training conducted in accordance with Section 01 79 00, Demonstration and Training.

3.04 HARDWARE SCHEDULE

- A. Schedule Designations: Typically, the numeric designations of specific manufacturers are used in the schedule for each item to indicate design, size, weight, finish function, and other features. With the exception of Designated Matching Products, products of other manufacturers will be acceptable if such products include the same features as the product listed. Refer to the General Conditions for provisions regarding trade names and alternatives.
- B. Refer to Hardware Schedule in the Contract Specifications Section 08 71 00, Door Hardware.

END OF SECTION 08 71 00

BART Facilities Standards (BFS)

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SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing.

1.02 RELATED SECTIONS

- A. Contractor, at its option, may furnish doors and windows factory-glazed and deliver such doors and windows to the site pre-glazed. Glass and glazing of factory-glazed doors and windows shall conform with the requirements specified herein.

1.03 MEASUREMENT AND PAYMENT

- A. General: Glass and glazing will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American National Standards Institute (ANSI):

- 1. ANSI Z97.1 Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

- B. American Society for Testing and Materials (ASTM):

- 1. ASTM C509 Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
- 2. ASTM C669 Specification for Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
- 3. ASTM C864 Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
- 4. ASTM C920 Specification for Elastomeric Joint Sealants
- 5. ASTM C1036 Specification for Flat Glass
- 6. ASTM C1048 Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
- 7. ASTM C1172 Specification for Laminated Architectural Flat Glass
- 8. ASTM D790 Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

- 9. ASTM D2240 Test Method for Rubber Property - Durometer Hardness
- 10. ASTM E773 Test Methods for Seal Durability of Sealed Insulating Glass Units
- 11. ASTM E774 Specification for Sealed Insulating Glass Units
- 12. ASTM F36 Test Method for Compressibility and Recovery of Gasket Materials

C. Code of Federal Regulations (CFR):

- 1. Title 16, Part 1201, Safety Standard for Architectural Glazing Materials (16 CFR 1201)

D. Glass Association of North America (FGMA):

- 1. FGMA Glazing Manual

E. National Fire Protection Association (NFPA):

- 1. NFPA 80 Fire Doors and Fire Windows

F. Underwriters Laboratories (UL):

- 1. UL 752 Bullet Resisting Equipment

1.05 REGULATORY REQUIREMENTS

A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:

- 1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 24, "Glass and Glazing".

1.06 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Product Data: Submit manufacturer's product data indicating compliance with specified requirements.

C. Samples:

- 1. Submit 8-inch by 10-inch sample of each type, thickness, and color of glass to be installed. Identify each sample with the manufacturer's name, product name, type of glass, thickness, color designation, and installation location. Protect sample edges for handler's safety.
- 2. Submit 10-inch samples of each type of glazing gasket, and tape, and glazing compound, identified with manufacturer's name, product name, and type of material.

D. Certificates: Submit certification that insulating glass units furnished and installed are faithful replicas of insulating glass units that have passed the program of testing specified in ASTM E773.

1.07 QUALITY ASSURANCE

- A. Regulatory Requirements: Glass and glazing shall comply with applicable requirements of the California Building Code, Chapter 24, ANSI Z97.1, and 16 CFR 1201.
- B. Tempered Glass:
1. Tempered and heat strengthened glass shall be horizontally treated; vertical treatment will not be acceptable. Fabrication and treatment shall be such that roller distortion lines (where they may occur) run horizontally (parallel to sill and head) after installation.
 2. Tempered glass shall bear the manufacturer's identification as to type and thickness. Such identification for glazing shall be permanently etched so as to be visible after glass has been installed. Glass other than fully tempered (FT) glass shall not have etched labels.
- C. Identification: Label each pane of glass and glass unit with type, thickness, quality, and color of glass and with manufacturer's trade name.
- D. Glazing: Glazing compounds and methods of glazing shall conform with applicable requirements of FGMA Glazing Manual.

PART 2 - PRODUCTS

2.01 GLASS

- A. Glass Standards and Requirements: Glass materials shall conform with ASTM C1036 for float glass and ASTM C1048 for heat-strengthened and tempered glass, as applicable. Types and thicknesses of glass shall be as indicated.
- B. Clear Float Glass: ASTM C1036, Type I, Class 1, Quality q3, with flat, smooth and glossy surfaces for architectural glazing.
- C. Tinted Float Glass: ASTM C1036, Type I, Class 2, Quality q3, of tint color indicated, with flat smooth and glossy surfaces for architectural glazing.
- D. Wired Glass: ASTM C1036, Type II, Class 1, Form 1, Quality q8, Mesh m1-Diamond or m2-Square as indicated. Glass for fire-rated doors shall conform with applicable requirements of NFPA 80.
- E. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
- F. Tinted Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3, of tint color indicated.

- G. Laminated Tempered Glass: Made up of two panes of fully tempered (FT), Type I, Class 1, Quality q3 glass of thicknesses indicated, with special 0.060-inch vinyl interlayer, meeting requirements of ASTM C1172.
- H. Insulating Glass: Preassembled unit, comprising two organically sealed panes of clear tempered glass separated by dehydrated (desiccated) air space, of sizes and thicknesses indicated, meeting requirements of ASTM E774.
- I. Bullet Resistant Plastic Glass: Monolithic or laminated polycarbonate sheets. Exterior shall be mar resistant. The assembly shall be have a flexure strength of not less than 13,500 psi in conformance with ASTM D790; have 87 percent light transmission; weigh not more than 5.1 lbs/sq.ft., and meet UL 752 Level 1 Bullet Resistant Acrylic.

2.02 GLAZING MATERIALS

- A. Setting Blocks and Spacers: ASTM C864, semi-hard neoprene or vinyl rubber, 70-90 Shore A hardness when tested in accordance with ASTM D2240, of width equal to thickness of glass and long enough to limit load on each block to 15 pounds per square inch. Minimum length of setting blocks shall be 3 inches.
- B. Glazing Gaskets: Continuous, closed-cell, extruded neoprene or vinyl rubber, channel type, manufactured for glazing in type of metal doors and frames indicated, conforming with applicable requirements of ASTM C509. Color shall be as selected by the Engineer from manufacturer's standards. Gaskets shall be capable of being compressed 40 percent of original size and shall have 100 percent recovery capability when tested in accordance with ASTM F36.
- C. Glazing Tape: Synthetic rubber sheet or strip material reinforced and stabilized with fabric mesh in center and treated with a bonding agent on both contact surfaces.
- D. Glazing Compounds:
 - 1. For Face Glazing: ASTM C669, elastic glazing compound, manufactured for back bedding and face glazing of metal sash, in color as selected by the Engineer from manufacturer's standards.
 - a. Include window manufacturer's glass-retaining glazing clips for face glazing.
 - 2. Elastomeric Joint Sealant: Sealant for glass to glass edge joints shall be a silicone sealant conforming with ASTM C920, black in color.
 - 3. For Channel Glazing: ASTM C669, elastomeric glazing compound, manufactured for glazing with metal stops and glazing beads of metal sash, conforming with applicable requirements of the FGMA Glazing Manual, in color as selected by the Engineer from manufacturer's standards.

PART 3 - EXECUTION

3.01 PREPARATION

GLAZING

- A. Obtain field dimensions of each opening that is to receive glass and cut each light to provide the optimal bite on, and clearance from, the sash or frame.
- B. Clean the surfaces that are to receive glass and glazing materials. Surfaces shall be free of dirt, corrosion, residue, and any other substance that may impair adhesion of glazing materials.
- C. Seal porous glazing channels or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive glazing compound.
- D. Do not perform glazing when ambient temperature is below 40 degrees F or during damp or rainy weather.

3.02 GLAZING

- A. General Glazing Requirements:
 - 1. Comply with applicable provisions of FGMA Glazing Manual and the California Building Code, Table No. 24-B, for minimum glazing requirements, and assure that minimum frame lap (minimum grip of glass) and edge clearances are provided as required for sizes of openings. Provide for expansion and contraction of glass as required.
 - 2. Conform with manufacturers' latest published installation instructions and recommendations for glazing of tempered glass, wired glass, laminated glass, and insulating glass. Follow manufacturers' latest published instructions for protection of edges and sizing of glass.
 - 3. Install glass in fire-rated assemblies in accordance with applicable requirements of NFPA 80.
 - 4. Provide setting blocks at quarter points along bottom of glass pane. Blocks shall support glass not less than 1/16 inch above metal. Provide spacers to hold glass in center between stops.
- B. Glazing of Hollow Metal Doors and Frames: Glass shall be set around all edges with glazing gaskets hereinbefore specified. Provide setting blocks and spacer blocks as required. Set gasket legs on both sides of glass. Gasket shall be continuous, notched only at top rail in the center. Compress gaskets at least 15 percent to form a tight seal.
- C. Glazing of Metal Windows with Compound:
 - 1. Face Glazing: Glass shall be glazed around all edges and exterior face of glass with glazing compound hereinbefore specified. Provide setting blocks and glazing clips as required. Clean surfaces to be glazed with solvent. Apply and compress glazing compound; smooth out and point with putty knife at 30-degree to 45-degree angle. Finished surfaces shall be uniformly smooth at required angle, mitered at corners.
 - 2. Channel Glazing: Install glass of type indicated. Provide setting blocks, spacers, and accessories as required. Install glass in full bed of glazing compound and secure with stops, as required. No metal shall touch glass. Strike surplus compound smoothly from both sides of glass. Do not undercut compound.

3.03 CLEANING AND REPLACEMENT

- A. Upon completion of glazing, remove paint spots, spatters, and other blemishes from glass.
- B. Assure that each light is identified as to type and grade of glass.
- C. Remove and replace glass panes that are cracked or broken and where distortion is evident and distracting, as determined by the Engineer.
- D. Remove paper labels, wash, and polish glass just before acceptance by the Engineer.
- E. Protect glass against damage from subsequent construction activities and vandalism.

END OF SECTION 08 80 00

SECTION 08 90 00

LOUVERS AND VENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Steel louvers.
- B. Aluminum louvers.

1.02 RELATED SECTIONS

- A. Sheet metal flashings are specified in Section 07 60 00 - Flashing and Sheet Metal.
- B. Gravity vents and smoke vents are specified in Section 07 70 00 - Roof and Wall Specialties and Accessories.
- C. Caulking and sealing are specified in Section 07 90 00 - Joint Protection.
- D. Soffit vents for cement plaster construction are specified in Section 09 24 11 - Portland Cement Plaster.
- E. Finish field painting of steel louvers is specified in Section 09 91 00 - Painting.

1.03 MEASUREMENT AND PAYMENT

- A. General: Louvers and vents will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.04 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 2605 Voluntary Specifications, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

1.05 INTERFACE AND COORDINATION

- A. Coordinate the Work of this Section with mechanical Work as required for providing combustion-air, air intake, and exhaust louvers and vents for mechanical equipment.

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit fully detailed Shop Drawings of louvers and vents, showing fabrication and installation details.

- C. Product Data: Submit manufacturer's performance data for louvers and vents, information on materials and fabrication, coating and colors, and installation instructions.
- D. Samples: Where louvers and vents are indicated to be factory finished, submit manufacturer's standard color chips for selection of color and texture by the Engineer.

1.07 QUALITY ASSURANCE

- A. Design Criteria: Structural supports for louvers and vents shall be designed by the manufacturer to withstand a positive and negative wind load of 30 pounds minimum per square foot.

PART 2 - PRODUCTS

2.01 STEEL LOUVERS

- A. Louver Type: Louvers shall be heavy-duty type, manufactured of 16 gage galvanized steel, of size, section profile, and configuration indicated, 4 inches deep. Include the furnishing of all accessories, frame, sill, anchors, and fasteners as required for a complete installation.
- B. Prime Coat: Louvers shall be bonderized and prime painted with a baked-on epoxy-based resin, corrosion-inhibitive metal primer.
- C. Bird Screen: Manufacturer's standard 1/2-inch wire mesh galvanized steel bird screen, mounted in removable frame and finished as specified for louvers.
- D. Fasteners: Stainless steel or other appropriate tempered steel treated with non-corrodible material as approved by the Engineer.

2.02 ALUMINUM LOUVERS

- A. Louver Type: Louvers shall be heavy-duty type, manufactured of 14 gage aluminum, of size, section profile, and configuration indicated, 4 inches deep. Include the furnishing of all accessories, frame, sill, anchors, and fasteners as required for a complete installation.
- B. Baked-Enamel Finish: All exposed aluminum surfaces shall be finished after fabrication with a satin finish, 70 percent fluoropolymer thermo-setting baked coating system which meets or exceeds the requirements of AAMA 2605. Minimum thickness shall be 1 mil. Color shall be as selected by the Engineer from manufacturer's standard color chart.
- C. Bird Screen: Manufacturer's standard 1/2-inch mesh aluminum bird screen, mounted in removable frame and finished as specified for louvers.
- D. Fasteners: Stainless steel, tempered aluminum, or other appropriate tempered steel treated with non-corrodible material as approved by the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

LOUVERS AND VENTS

- A. Check site dimensions affecting this work. Ensure openings affecting this work are properly prepared and that flashings are correctly located to divert moisture to the exterior.

3.02 INSTALLATION

- A. Louvers and vents, including bird screen and accessories, shall be installed as indicated and in accordance with the approved Shop Drawings and the louver manufacturer's installation instructions and recommendations.
- B. Louvers and vents shall be completely caulked and sealed around their perimeters with sealant and tape as required.
- C. Exterior louvers and vents, at completion of installation, shall provide rainproof, leakproof service.

END OF SECTION 08 90 00

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5.9 Division 9

Finishes

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SECTION 09 01 36

TILE REPLACEMENT AND RESTORATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Removal of existing tile.
- B. Cleaning of tile and grout.
- C. Installation of new tile.

1.02 RELATED SECTIONS

- A. Porcelain stone, ceramic and quarry tiles are specified in Section 09 30 00 - Tiling.

1.03 DESCRIPTION

- A. The station or building involved in this work will be in continuous operation during the construction period. This will require that the Contractor plan the Work carefully to work around unavoidable obstacles in the prosecution of the Work. It will require further that the Contractor complete some new construction facilities required in the renovation work before proceeding with the tile restoration and replacement work.
- B. Provide such additional temporary facilities as may be required to facilitate continuous, unobstructed station or building operation during transitional construction work.

1.04 MEASUREMENT AND PAYMENT

- A. General: Tile restoration and replacement will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.05 REFERENCES

- A. Comply with the Referenced Standards specified in Section 09 30 00 - Tiling, as applicable to the tile restoration and replacement work. Include the following additional standard:
 - 1. American National Standards Institute (ANSI):
 - a. ANSI A118.9 Cementitious Tile Backer Board

1.06 SUBMITTALS

- A. Provide submittals in accordance with the requirements of Section 09 30 00 - Tiling, as applicable to the tile restoration and replacement work, for the Engineer's view.

1.07 QUALITY ASSURANCE

- A. Tile restoration and replacement work shall conform with the installation instructions and recommendations of the manufacturer of the ceramic and quarry tiles to be provided for this work.
- B. Quality assurance for the tile restoration and replacement work shall conform with the quality assurance requirements of Section 09 30 00 - Tiling, as applicable.

1.08 FIELD MOCK-UP

- A. Provide field mock-up where large panels of new tile are involved requiring color and texture selection. Conform with requirements of Section 09 30 00 - Tiling, as applicable to this work.

1.09 PRODUCT DELIVERY AND STORAGE

- A. Comply with applicable requirements of Section 09 30 00 - Tiling.

1.10 JOB CONDITIONS

- A. Comply with applicable requirements of Section 09 30 00 - Tiling.

1.11 MAINTENANCE MATERIALS

- A. Comply with applicable requirements of Section 09 30 00 - Tiling.

PART 2 – PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. Provide all materials, equipment, tools, appurtenances, facilities, and services as required for performing and completing the tile restoration and replacement work as indicated.
- B. Where new materials and accessories are required to complete the tile restoration work as indicated, such new materials and accessories shall conform with the requirements of Section 09 30 00 - Tiling, as applicable to the work.
- C. Where removal of existing tile damages existing substrate, replace such damaged substrate with ANSI A118.9 cementitious tile backer board. If damaged substrate is metal lath and cement plaster, conform with applicable requirements of Section 09 24 11 - Portland Cement Plaster.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Carefully remove existing tile, where indicated, with proper tools and methods. Include remove of existing setting beds.
- B. After removal of existing tile, examine existing substrate surfaces and related framing for damage. Damaged or defective substrate surfaces and framing shall be repaired or replaced as required to provide substantial framed substrate surfaces conducive to the installation of new tile and trim shapes and as required to produce superior quality work.

- C. Where the substrate is concrete or concrete block, chip off existing mortar setting bed, and then power wire brush to remove all loose particles and to provide clean, solid backing surface for new tile. Wash clean all substrate surfaces before application of new tile.
- D. Verify that the work of other trades, to be in or behind new tile, is properly installed before proceeding with tile work.
- E. Seal around all openings in floors and walls, at junction of floors and walls, and in corners and joints with sealant before installing new tile.

3.02 INSTALLATION STANDARDS

- A. Comply with requirements specified in Section 09 30 00 - Tiling, as applicable to this work.

3.03 INSTALLATION AND GROUTING

- A. Comply with requirements specified in Section 09 30 00 - Tiling, as applicable to this work.
- B. Clean existing tile to remain, and point all grouted joints as required to fill all skips and gaps. Wash all tile and grouted joints, and polish tile upon completion.

3.04 TOLERANCES AND QUALITY CONTROL

- A. Comply with the requirements specified in Section 09 30 00 - Tiling, for tolerances and field quality control as applicable to this work.

3.05 CLEANING AND PROTECTION

- A. Comply with the requirements specified in Section 09 30 00 - Tiling, for cleaning of tile and for protection of completed work as applicable to this work.

END OF SECTION 09 01 36

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SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal stud system.
- B. Ceiling suspension system.
- C. Metal furring.

1.02 RELATED SECTIONS

- A. Cold-formed lightgage metal structural framing (16 and 18 gage studs and joists) is specified in Section 05 40 00 - Cold-Formed Metal Framing.
- B. Gypsum wallboard is specified in Section 09 29 00 - Gypsum Board.

1.03 MEASUREMENT AND PAYMENT

- A. General: Metal support systems for gypsum drywall construction will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American Society of Civil Engineers (ASCE):
 - 1. ASCE 7 Minimum Design Loads for Buildings and Other Structures
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C645 Specification for Non-Load Bearing (Axial) Steel Studs, Runners (Tracks), and Rigid Furring Channels for Screw Application of Gypsum Board
 - 2. ASTM C754 Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board
 - 3. ASTM C1002 Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
 - 4. ASTM E497 Practice for Installing Sound-Isolating Lightweight Partitions

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements which govern the work of this Section include the following governing code:

1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapters 25 and 25A, "Gypsum Board and Plaster."

1.06 SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submit manufacturer's product data for ceiling suspension systems, including details of seismic bracing.

1.07 QUALITY ASSURANCE

- A. Installation: Comply with the applicable requirements of ASTM C754.
- B. Deflection: Unless otherwise indicated, allowable design deflection shall be $L/360$, based on requirements of ASCE 7.

PART 2 - PRODUCTS

2.01 METAL STUD SYSTEM

- A. Studs: Typically 20 gage, 22 gage, and 25 gage as indicated, galvanized punched "C" or channel studs, of sizes indicated, conforming to ASTM C645. Furnish studs with punch-outs for pipes and conduits and with provision for interlocking a 1-1/2 inch reinforcing channel. Furnish bridging, extension splice plates, and channel reinforcing as required for a complete installation.
- B. Floor and Ceiling Tracks: Unpunched channels of the same size and type as required for the studs installed therein, and of the same metal gage as studs.
- C. Bolts: 1/4-inch diameter galvanized steel machine bolts. Provide galvanized washers for bolt heads and nuts.
- D. Powder-Driven Fasteners: Low-velocity powder-driven fasteners, 1/4-inch or 3/8-inch diameter, with penetration of 3/4 inch, may be used for attaching floor and ceiling tracks in lieu of anchor bolts. Use washers with all inserts. Powder-driven fasteners will not be permitted for use on concrete curbs, at rough openings, along the edge of concrete or a concrete joint, or for penetrating metal decking.
- E. Expansion Bolts: Galvanized expansion type anchors with matching galvanized bolts, minimum 1/4-inch diameter, may be used for attaching floor and ceiling tracks in lieu of anchor bolts. Use washers under all bolt heads and nuts. Expansion bolts shall be located at least 4 inches from the edges or corners of concrete. Use of expansion bolts requires prior approval of the Engineer.
- F. Screws: Screws for securing splice plates to studs and stud legs to tracks and at other locations as required shall be Phillips-head, Type S, contoured, self-drilling, self-tapping, steel drywall screws, conforming to ASTM C1002, of required lengths.
- G. Backing Plates: Minimum 16 gage galvanized steel, 4 inches or more in height, and in lengths as required to span two or more stud spacings.

- H. Sealant: Provide interior sealant for floor and ceiling track beads at acoustical walls and partitions and other locations where indicated, meeting requirements specified in Section 07 90 00 - Joint Protection, for the location.
- I. Miscellaneous Items: Provide such miscellaneous components, channels, angles, bracing, hangers, and wire as required to complete the installation. Include proper type cell or flute closures for metal decking where partitions extend to underside of floor or roof decking above.

2.02 CEILING SUSPENSION SYSTEM

- A. Field-Fabricated Ceiling Suspension System:
 1. Carrying Channels: Standard structural steel channels, hot-dipped galvanized, typically 1-1/2 inch section with flanges not less than 7/16-inch wide, weighing not less than 486 pounds per 1000 linear feet.
 2. Hanger Wires: Soft steel wire not less than 0.1620-inch nominal diameter (8 or 9 gage) with Class 2 zinc coating.
 3. Turnbuckles: Zinc-coated steel or wrought iron turnbuckles with hook and hook-end pulls.
 4. Furring Channels: 25 gage, electro-galvanized, roll-formed steel, hat- or trough-shaped channels, 7/8-inch deep, conforming to ASTM C645.
 5. Clips: Standard product of the gypsum board manufacturer, manufactured specifically for the purpose of fastening furring channels to carrying channels, of size required for size of carrying channels.
- B. Manufactured Ceiling Suspension System: The Contractor may provide a proprietary manufactured ceiling suspension system meeting indicated requirements, furnished complete with all components, anchors, fasteners, and accessories as required for a complete and finished installation.

2.03 METAL FURRING

- A. 25 gage, electro-galvanized, standard drywall furring channels, hat- or trough-shaped furring channels, or z-furring channels, as indicated or required, conforming to ASTM C645.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation Standards: For details not indicated, comply with applicable requirements of the California Building Code, Chapter 25, and ASTM C754. For installation of framing for acoustical or sound-retardant partitions, comply with applicable requirements of ASTM E497.
- B. Metal Stud Systems:
 1. Provide tracks as continuous top and bottom supports and anchors for all studs. Apply two parallel continuous beads of acoustical sealant under each floor and ceiling track at sound-insulated partitions.

2. Install powder-driven fasteners in accordance with the fastener manufacturer's installation instructions and recommendations. Maximum penetration in post-tensioned slabs: 3/4 inch.
3. Install expansion bolts, where approved for use, in snug-fitting, smoothly drilled holes in accordance with the expansion-bolt manufacturer's installation instructions and recommendations. Anchors require specific acceptance by the Engineer before they may be used in post-tensioned slabs.
4. Locate and align floor tracks accurately. Secure to floor with anchor bolts, powder-driven fasteners, or expansion bolts at 24 inches on centers and not less than 6 inches from ends of each piece of floor track. Install anchors with washers.
5. Align ceiling tracks accurately by plumbing up from floor tracks. Fasten to structure above as specified for floor tracks for concrete or metal-deck soffits or as required by the type of construction. Provide bracing as required when tracks parallel ceiling furring channels.
6. Install metal studs in floor and ceiling tracks at a maximum spacing of 24 inches on center, unless indicated otherwise, and attach to tracks with screws or appropriate clips. Spliced studs will not be permitted.
7. Provide bridging between all studs as recommended by the manufacturer and as required by applicable codes.
8. Frame door jambs with two nested channel studs or 16 gage steel studs as specified in Section 05 40 00 - Cold-Formed Metal Framing. Install reinforcing channels above headers, carried to the second stud past each jamb member. Carry jamb members full height to structure above, unless indicated otherwise.
9. Install backing plates and reinforcing of the various types indicated or required for the mounting of all items on or in partitions, walls, or shafts. Exact position of backing work shall be as designated by the trade whose work will be fastened thereto. The end result shall be that all items attached to or in gypsum board surfaces shall be firmly and solidly mounted.
10. Frame all openings in partitions with stud sections or sills and header members. Secure stud sections or sills and header members, by screws, bolts, rivets, or welding as required.
11. Provide any miscellaneous steel sections indicated or required to complete the Work.
12. Erection technique shall result in plumb and straight walls with no waves or buckles or unevenness at joints. Finished walls shall be flat within plus or minus 1/8 inch in 8 feet when checked in any direction with an 8-foot straightedge and plumb to within plus or minus 1/8 inch.

C. Ceiling Suspension System, Field Fabricated or Manufactured System:

1. Install ceiling suspension system, hanger wires, carrying channels, and furring channels, as indicated and in accordance with the component manufacturer's installation instructions and detail drawings.

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2. Unless otherwise indicated, maximum spacing for hanger wires and carrying channels shall be 4 feet on centers.
 3. Fasten hanger wires securely to the structure above with proper anchors as recommended by the suspension system components' manufacturer and as required to meet applicable code requirements.
 4. Locate main runners (carrying channels) within 6 inches of parallel walls and cut them short of abutting walls 1/2 inch.
 5. Space furring channels 24 inches on center, unless indicated otherwise. Fasten furring channels to main runners with clips manufactured for the purpose.
 6. Provide support bracing, diagonal bracing, reinforcing, anchors and fasteners, channels, and any other miscellaneous components as indicated or required for a complete installation and as necessary to meet seismic requirements.
 7. At completion, ceiling systems shall be level in all directions within plus or minus 1/8 inch when checked with a transit or water level.
- D. Furring on Concrete and Masonry: Fasten hat-shaped or Z-type drywall furring channels securely to concrete and masonry with concrete nails, powder-driven fasteners, or expansion bolts in accordance with the drywall material manufacturer's instructions and recommendations. Concrete nails shall penetrate concrete a minimum of one inch. Nails, fasteners, or expansion bolts shall be installed with washers.

END OF SECTION 09 22 00

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SECTION 09 24 11

PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Building paper.
- B. Lath.
- C. Exterior cement plaster (stucco).

1.02 RELATED SECTIONS

- A. Ceramic tilework specified in Section 09 30 00 - Tiling.

1.03 MEASUREMENT AND PAYMENT

- A. General: Portland cement plaster work will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM A653/
A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 2. ASTM B69 Specification for Rolled Zinc
 3. ASTM C150 Specification for Portland Cement
 4. ASTM C206 Specification for Finishing Hydrated Lime
 5. ASTM C847 Specification for Metal Lath
 6. ASTM C897 Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters
 7. ASTM C926 Specification for Application of Portland Cement-Based Plaster
 8. ASTM C932 Specification for Surface-Applied Bonding Agents for Exterior Plastering
 9. ASTM C954 Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

- 10. ASTM C1002 Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases

B. International Conference of Building Officials, Uniform Building Code (UBC):

- 1. UBC Std. 14-1 Kraft Waterproof Building Paper

1.05 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:

California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapters 14 and 14A, "Exterior Wall Coverings," and Chapters 25 and 25A, "Gypsum Board and Plaster."

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit Shop Drawings showing locations of all expansion and control joints in elevation and details of such joints.
- C. Product Data: Submit manufacturer's product data to accompany each manufactured item that requires a sample to be submitted.
- D. Samples:
 - 1. Submit 12-inch-long samples of each type of lath, expansion and control joint, weep screed, corner bead, and other metal accessories to be used in the work.
 - 2. Submit 8-inch by 10-inch sample panel of proposed cement plaster finish.

1.07 DELIVERY AND STORAGE OF MATERIALS

- A. Deliver manufactured materials in their original packages and containers, bearing name of manufacturer and brand. Store cement, plaster, and lime in assigned room or area and away from damp surfaces. Remove damaged or deteriorated materials from the site.

1.08 PROTECTION

- A. Protect surfaces adjacent to plastering work from spattering or other staining caused by plastering. Surfaces so spattered or stained shall be cleaned to the satisfaction of the Engineer within 24 hours of application.
- B. Protect plaster work from subsequent construction and finishing activities, and maintain protection until acceptance of the work by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Building Paper: At exterior walls and soffits, provide "breathable" weather-resistive barriers as required by the California Building Code, Chapter 14A, Section 1402A.1, conforming with UBC Std. 14-1, Grade D building paper.
- B. Lath:
 - 1. Stucco Netting: Standard No. 18 gage, one inch hexagonal mesh, galvanized stucco lath, self-furring. Plain stucco netting may be used over sheathing and building paper with the use of 1/4-inch furring washers.
 - 2. Expanded Metal Lath: ASTM C847, diamond mesh, expanded copper-bearing steel, galvanized, weighing 3.4 pounds per square yard, self-furring.
- C. Lathing Accessories:
 - 1. Provide corner reinforcement, base, drip, and weep screeds, strip lath, control and expansion joints, soffit vents, and any other accessories indicated or required to complete the installation. Lathing accessories shall be standard manufactured products, manufactured specifically for the purpose.
 - 2. Lathing accessories for exterior cement plaster shall be fabricated from zinc sheet conforming to ASTM B69.
 - 3. Lathing accessories for interior cement plaster shall be fabricated from galvanized steel sheet conforming to ASTM A653/A653M.
 - 4. Control and expansion joints shall be provided with removable tape to prevent plaster from filling the joint.
- D. Lath Tie Wire: No. 18 gage galvanized soft steel wire.
- E. Lath Fastenings: Self-drilling, self-tapping, steel screws, conforming to ASTM C954 or ASTM C1002, as applicable for type of metal framing, of required lengths. Include metal washers for engaging lath and furring washers for spacing stucco netting 1/4 inch from sheathing board or metal framing as applicable.
- F. Portland Cement: ASTM C150, Type II, low alkali.
- G. Aggregate: ASTM C897.
- H. Lime: ASTM C206.
- I. Water: Fresh, clean and potable, and free from such amounts of mineral and organic substances as would adversely affect the hardening and strength of cement plaster.
- J. Exterior Cement Plaster (Stucco) Finish Coat: Cement-lime cement plaster (stucco) finish coat or an approved manufacturer's prepared premixed cement plaster (stucco) finish coat, meeting requirements of ASTM C926, for stucco, in sandfloat finish. Exact texture shall be as selected and approved by the Engineer from samples prepared and submitted by the Contractor.

- K. Fiber Reinforcement: Chopped strands of alkali-resistant polypropylene fiber, 1/2- inch long, for use in scratch coat only.
- L. Bonding Agent: ASTM C932, for bonding of cement plaster to concrete or masonry substrate.

PART 3 - EXECUTION

3.01 APPLICATION OF BUILDING PAPER

- A. Apply building paper, before lathing, over all exterior sheathing board for surfaces to receive cement plaster (stucco) in compliance with the California Building Code, Chapter 14, Section 1402, Chapter 14A, Section 1402A, Chapter 25, Section 2506 and Chapter 25A, Section 2506A. Apply building paper over sheathing in two separate layers or plies, as follows:
 1. Apply first layer over sheathing horizontally, lapping sides 2 inches to weather and 6 inches at ends. Secure sufficiently with staples, or other acceptable fasteners, to hold in place without sagging until second layer is applied.
 2. Apply second layer over first layer, again horizontally, lapping sides 6 inches to weather and ends 6 inches. Secure sufficiently with staples to hold in place without sagging until lath is applied. Horizontal joints of second layer shall not occur directly over horizontal joints of first layer.

3.02 APPLICATION OF LATH

- A. Apply stucco lath directly over sheathing and framing members with screws specified, spaced not more than 6 inches apart vertically and 16 inches apart horizontally, directly over framing members. Screws shall engage the lath securely with washers as required. Laps of stucco lath shall be 1 inch minimum and shall be laced with 18 gage galvanized soft steel wire. If plain or standard stucco netting is used, apply in same manner, except that fasteners shall include furring washers.
- B. At soffits, use 3.4 pound galvanized expanded metal lath, reinforced with standard 18 gage stucco netting applied over the expanded lath with screws and furring washers. Apply expanded metal lath directly over building paper and sheathing, and then apply stucco netting directly over expanded metal lath, fastening both securely 6 inches on center directly to framing (through sheathing). All laps shall be securely laced with tie wire.
- C. Install all required plaster grounds, base, drip, and weep screeds, corner reinforcement, special stops, control joints, strip lath, soffit vents, and other metal accessories. Apply and shim out to required thickness. Set plumb, level and straight, free of kinks and bends. Install casing beads or stops at edges of plaster continuously. Provide expansion joints where indicated. Provide control joints where indicated, or if not indicated, in accordance with the following requirements:
 1. Where dissimilar substrate materials meet, such as concrete or concrete block and metal studs.
 2. In line with control joints in masonry substrate.

3. Above and in-line with door jambs.
 4. In any wall or ceiling area bounded by expansion or control joints otherwise required, provide control joints on a regular pattern so that the total area bounded by control or expansion joints does not exceed 100 square feet.
 5. Obtain the Engineer's approval of locations before installing control joints.
- D. Make intersections and splices of lathing accessories in accordance with manufacturer's instructions. When horizontal and vertical expansion and control joints meet, make the vertical joint unbroken.
- E. Break lath behind expansion and control joints. Do not fasten opposite sides of expansion and control joints to a monolithic backing material. Where cement plaster is backed by studs, provide a stud on either side of the joint.

3.03 APPLICATION OF EXTERIOR CEMENT PLASTER (STUCCO)

A. General Requirements:

1. Exterior cement plaster shall be applied in three-coat work to a minimum thickness of 7/8 inch, and shall be finished in texture matching the approved sample or job mockup.
2. Scratch coat ingredients shall include glass fiber or polypropylene fiber reinforcement at the rate of 1-1/2 to 2 pounds per 94 pound bag of cement.
3. Proportions of portland cement, lime, and aggregate shall be within the limits specified in ASTM C926.

B. Application:

1. Scratch Coat: Scratch coat shall be applied to minimum thickness of 3/8 inch, completely embedding the lath. Scratch coat shall be scratched horizontally to provide mechanical key, and properly cured before applying brown coat.
2. Brown Coat: Brown coat shall be applied to minimum thickness of 3/8 inch in two applications and shall be brought to a true, even plane by rodding and floating, and shall be left rough and ready to receive the finish coat. Scratch coat shall be dampened to provide suction before applying brown coat. Brown coat shall be properly cured before applying finish coat.
3. Finish Coat: Finish coat shall be laid out to permit the completion of an entire surface in one operation. Finish coat shall be applied to minimum thickness of 1/8 inch, or in such thickness as may be necessary to ensure the full thickness specified. Brown coat shall be dampened evenly to provide suction before applying finish coat.

- C. Application Over Concrete or Masonry: Where cement plaster is to be applied directly over concrete or masonry, only brown coat and finish coat are required. Substrate surfaces shall be roughened as necessary and cleaned, and a bonding agent shall be applied, in accordance with manufacturer's instructions, before applying the brown coat.

3.04 WORK QUALITY

- A. Finished surfaces shall be uniform as to texture and color throughout the area. Intersections of planes shall be sharp and accurate. Plane surfaces shall be finished plumb, straight, and true to plus or minus 1/8 inch when tested with an 8-foot straightedge.
- B. Where plaster stops, screeds, control or expansion joints, angles, wall panels, or other features are employed for architectural treatment, panels framed by these accessories or other construction shall be finished in one operation. No stopping vertically or horizontally in the middle or intermediate area of a panel will be permitted.
- C. Imperfections that occur after curing and drying shall be properly repaired.

3.05 CURING AND PROTECTION OF PLASTER

- A. Comply with applicable requirements of ASTM C926. Each coat of cement plaster shall be moist cured by application of fine fog spray for a minimum period of four days. Moistening shall begin as soon as the plaster has hardened sufficiently. Soaking of walls shall be avoided.
- B. Apply only as much water as will be readily absorbed. Protect plaster from uneven and excessive evaporation during hot, dry weather. Provide for curing of plaster on Saturdays, Sundays, and holidays, if necessary.
- C. Protect cement plaster against damage from cold or too rapid drying or from any other cause.

END OF SECTION 09 24 11

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Gypsum wall board.
- B. Fire-rated board.
- C. Water-resistant (W/R) backing board.
- D. Joint compound and tape.
- E. Accessories.
- F. Screws.
- G. Sealant.

1.02 RELATED SECTION

- A. Cementitious backer board for ceramic tile is specified in Section 09 30 00 - Tiling.

1.03 MEASUREMENT AND PAYMENT

- A. General: Gypsum drywall construction will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 DESCRIPTION

- A. When a fire resistance rating is indicated for a gypsum board assembly, details of construction shall be in accordance with reports of fire tests of assemblies which have met the requirements of the indicated fire rating.
- B. When a sound transmission class (STC) rating is indicated for a gypsum board assembly, details of construction shall be in accordance with reports of acoustical tests of assemblies which have met the requirements of the indicated acoustical rating.
- C. Details of construction not specified herein shall conform to applicable requirements of ASTM C840.

1.05 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C11 Standard Terminology Relating to Gypsum and Related Building Materials and Systems
 - 2. ASTM C36 Specification for Gypsum Wallboard

GYPSUM BOARD

3. ASTM C475 Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
4. ASTM C630 Specification for Water-Resistant Gypsum Backing Board
5. ASTM C840 Specification for Application and Finishing of Gypsum Board
6. ASTM C954 Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
7. ASTM C1002 Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
8. ASTM C1047 Specifications for Accessories for Gypsum Wallboard and Gypsum Veneer Base
9. ASTM E497 Standard Practice for Installing Sound-Isolating Lightweight Partitions

1.06 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements which govern the work of this Section include the following governing code:
 1. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapters 25 and 25A, "Gypsum Board and Plaster."

1.07 DEFINITIONS

- A. Words and terms used in this Section and not defined herein shall be interpreted in accordance with the definitions given in ASTM C11.

1.08 QUALITY ASSURANCE

- A. Installation and Finishing: Comply with applicable requirements of the California Building Code, Chapters 25 and 25A, and ASTM C840.
- B. Installation of Sound-Retardant Partitions: Comply with applicable requirements of ASTM E497.

1.09 JOBSITE CONDITIONS

- A. Maintain room temperature of not less than 40 degrees F during application of gypsum board, and 50 degrees F during application of joint treatment and for 48 hours thereafter. If temporary heat is provided, do not allow the temperature to exceed 95 degrees F.
- B. Maintain adequate ventilation in the working area during installation and finishing.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

GYPSUM BOARD

- A. Deliver materials to the site and store them in the work area if possible, so that materials will have a minimum period of 24-hours storage at the same temperature as the installation area.
- B. Store gypsum board in the horizontal position. When necessary to stack palettes, align blocking vertically to avoid distortion of boards.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Board Type and Thickness: Refer to indicated details and notes on the Contract Drawings for type and thickness of board. Where thickness is not indicated, provide 5/8-inch-thick board.
- B. Gypsum Wallboard: ASTM C36, furnished with tapered longitudinal edges and in lengths which will result in a minimum footage of joints.
 - 1. Provide foil-backed gypsum wallboard for interior facing of exterior walls where gypsum wallboard is scheduled for the interior finish and for gypsum wallboard furred over concrete or masonry.
- C. Fire-Rated Board: Provide Type X board for assemblies indicated to have a fire-resistance rating.
- D. Water-Resistant (W/R) Backing Board: ASTM C630, 5/8-inch thick. Provide Type X water-resistant gypsum backing board where water-resistant gypsum board walls and ceilings are indicated to have a fire-resistance rating.
- E. Joint Compound and Tape: ASTM C475, joint tape, taping compound, and finishing compound. All-purposed compound may be substituted for taping compound and finishing compound.
- F. Accessories: ASTM C1047, galvanized steel. Provide metal corner bead for all external corners and angles and metal edge trim at all junctions of gypsum wallboard and walls of other materials and for all exposed edges.
- G. Screws: ASTM C954 or ASTM C1002, as applicable for type of metal framing, of required lengths.
- H. Sealant: Sealant for holes or penetrations in acoustical and damp-service partitions shall conform to applicable requirements of Section 07 90 00 - Joint Protection.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Apply gypsum wallboard in accordance with applicable requirements of ASTM C840.
- B. Before applying gypsum board, verify that corners and framing are plumb, true, and solid. Apply no gypsum board until conduits, boxes, pipes, ducts, vents, supports, fixture frames,

blocking and backing, and the like are in place and inspected, tested, and approved as required. All edges and ends of gypsum board shall have solid bearing.

- C. Apply wallboard over metal framing and furring with self-drilling, self-tapping screws installed with an electric screw-gun equipped with adjustable screw depth control. Drive screw heads slightly below the surface of the wallboard, taking care to avoid breaking the paper face or fracturing the gypsum core. Space screws a maximum of 12 inches on center in the field of boards and 8 inches on center staggered along the abutting edges for walls, and 7 inches on center along abutting edges for ceilings. Do not drive screws closer than 3/8 inch from edges and ends.
- D. Apply wallboard first to ceilings and then to walls, using maximum practical lengths to minimize end joints. End joints will not be permitted on walls or partitions less than 16 feet in height. Wallboard shall be applied vertically to walls. Joints on opposite sides of the same wall or partition shall occur on different studs. Boards shall be installed in moderate contact, not forced in place.
- E. In two-ply gypsum board construction, apply the base ply perpendicular to framing members and the face ply parallel to framing members. Laminate face-ply to base-ply with adhesive or all-purpose compound. Fasten with a sufficient number of screws to hold the board in place until the laminating adhesive or compound has set, but not less than 12-inch spacing on ceilings and 16-inch spacing on walls. Joints in the face ply shall be offset from joints in the base ply by not less than 16 inches.
- F. Provide metal corner bead at all vertical and horizontal external corners and angles. Provide metal edge trim at all junctions of gypsum wallboard and walls of other materials or where there are exposed edges.
- G. At acoustical or sound walls, penetrations of walls shall have a minimum clearance of 1/4 inch along their perimeters at wallboard, which shall be filled with sealant. Fill all voids completely with sealant. Install wallboard 1/4 inch to 3/8 inch above floor and fill resultant space with sealant. Achieve maximum sound insulation through careful installation work in jointing, sealing, taping, and staggering of joints.
- H. Gypsum wallboard surfaces shall have a maximum variation of 1/8 inch in 8 feet when a straightedge is laid on the surface in any direction.

3.02 TAPING AND FINISHING

- A. Tape and finish all joints, corners, metal accessories, screw heads, damaged or abraded surfaces, and cutouts for the work of other trades in accordance with ASTM C840 and the drywall materials manufacturer's instructions and recommendations.
- B. Joints, wall and ceiling angles, and inside vertical corners shall be reinforced with tape embedded in taping compound and finished with not less than two applications of finishing compound, allowing each application to dry thoroughly and sanding between coats as required. Dimples at screws heads and other imperfections shall be similarly treated.
- C. External corners, edges, and ends with metal beads and edge trim shall have the flanges completely spackled and feathered off smooth from the nose.

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- D. Final application of finishing compound and sanding shall leave gypsum wallboard surfaces uniformly smooth and in proper condition to receive a painted finish.
- E. Type X gypsum backing board shall be fire-taped as required.

END OF SECTION 09 29 00

BART Facilities Standards (BFS)

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SECTION 09 30 00

TILING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Tile.
- B. Marble thresholds.
- C. Setting bed and adhesive.
- D. Grout.
- E. Reinforcement.
- F. Cleavage membrane.
- G. Sealant.
- H. Cementitious backer board.
- I. Cementitious backer board accessories.

1.02 RELATED SECTIONS

- A. Lath and portland-cement plaster backing (scratch coat) for wall tile applied over full mortar setting bed is specified in Section 09 24 11 - Portland Cement Plaster.
- B. Granite flooring is specified in Section 09 63 19 - Stone Flooring.

1.03 MEASUREMENT AND PAYMENT

- A. General: Ceramic and quarry tilework will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A108.1 Installation of Ceramic Tile with Portland Cement Mortar
 - 2. ANSI A108.4 Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
 - 3. ANSI A108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
 - 4. ANSI A108.6 Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy

TILING

5. ANSI A108.10 Installation of Grout in Tilework
6. ANSI 108.11 Interior Installation of Cementitious Backer Units
7. ANSI A118.1 Specifications for Dry-Set Portland Cement Mortar
8. ANSI A118.3 Specifications for Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive
9. ANSI A118.4 Specifications for Latex-Portland Cement Mortar
10. ANSI A118.6 Specifications for Ceramic Tile Grouts
11. ANSI 118.9 Cementitious Backer Units
12. ANSI A136.1 Organic Adhesives for Installation of Ceramic Tile
13. ANSI A137.1 Ceramic Tile

B. American Society for Testing and Materials (ASTM):

1. ASTM C144 Specification for Aggregate for Masonry Mortar
2. ASTM C150 Specification for Portland Cement
3. ASTM C207 Specification for Hydrated Lime for Masonry Purposes
4. ASTM C920 Specification for Elastomeric Joint Sealants
5. ASTM C1325 Specification for Non-Asbestos Fiber-Mat Reinforced Cement Interior Substrate Sheets
6. ASTM D2178 Specification for Asphalt Glass Felt Used in Roofing and Waterproofing

C. Tile Council of America (TCA):

1. TCA Handbook for Ceramic Tile Installation

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit fully detailed Shop Drawings, showing tile layouts, dimensions, bedding and joint details, and connections to adjoining work.

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- C. Product Data: Submit manufacturer's specifications, catalog cuts, color range of tile, data sheets, installation instructions, and maintenance instructions. Include certifications and other data to show compliance with Contract requirements.
- D. Samples: Submit samples of each type, class, finish, and color of tile and grout, not less than 12 inches square, on plywood backing, with grouted joints as indicated. Include at least one complete grouted tile intersection. Samples shall show full range of color and texture. Samples shall match the Engineer's control samples. Samples require approval of the Engineer before they may be used in the work.

1.06 QUALITY ASSURANCE

- A. Master Grade Certificates: Furnish a Master Grade Certificate as specified in ANSI A137.1 for each type of tile, signed by the manufacturer and the Contractor, certifying to the grade, type and quantity of tile, together with satisfactory information for identification of the containers to which they apply.
- B. Control Samples: Tile shall match the Engineer's control samples in all respects. Control samples require the Engineer's approval before they may be used as a standard.
- C. Single Source Responsibility: Obtain each material required for any one type and color of tilework from a single source to minimize variations in appearance and quality.
- D. Installation Standards: Comply with TCA Handbook for Ceramic Tile Installation and the herein referenced standards for all tile installations.

1.07 FIELD MOCK-UP

- A. Requirements: Provide field mock-ups, as specified, for the Engineer's approval.
- B. Typical Floor Panel: The Contractor shall install a typical floor panel, approximately 3-feet square in an appropriate location. Mock-up shall include joint treatment and other accessories as required for a finished installation. Keep panel damp until mortar has set; dry slowly to attain true appearance of finished work. Maintain accepted panel as the standard for completed work. Provide a typical floor panel for each different type of tile flooring and floor design indicated.
- C. Typical Wall Panel: The Contractor shall install a typical wall panel, approximately 3 feet by 4 feet, in an appropriate location. Mock-up shall include joint treatment, trim shapes, wainscot cap when applicable, cove base, and other accessories as required for a finished installation. Keep panel damp until mortar has set; dry slowly to attain true appearance of finished work. Maintain accepted panel as the standard for completed work. Provide a typical wall panel for each different type of tile wall and wall design indicated.
- D. Acceptance: Approved typical floor and wall panels will be used to establish acceptable minimum standards of appearance and work quality. Acceptance will be based on uniformity, color match, proper texture, and proper construction methods.

1.08 PRODUCT DELIVERY AND STORAGE

- A. Deliver materials, other than bulk materials, in manufacturer's unopened containers, fully identified with name, brand, type, grade, class, size, color, and pattern. Store materials above

TILING

ground and protect from weather and damage. Store in accordance with the respective manufacturer's instructions.

1.09 JOB CONDITIONS

- A. Examine substrates and adjoining construction, and the conditions under which tilework is to be installed. Do not proceed with tilework until conditions detrimental to the proper and timely completion of this work have been corrected.
- B. Allowable Variations in Substrate Levels:
 - 1. For Full Mortar Setting Bed Floors: plus or minus 1/4 inch in ten feet in any direction and 3/8 inch total maximum variation from levels indicated.
 - 2. For Full Mortar Setting Bed Walls: plus or minus 1/8 inch in 8 feet in any direction and 1/4 inch total maximum variation from indicated planes.
 - 3. For Thin-Set Tilework: Substrate shall conform with the allowable variations in finished work as specified in Article 3.03 herein. Where floor drains occur, substrate shall have minimum slope of 1/8 inch per foot to drain.
- C. Set tile and grout tile joints when ambient temperature is above 50 degrees F. Do not set or grout tile when ambient temperature is above 90 degrees F.

1.10 MAINTENANCE MATERIALS

- A. Upon completion of the Work, deliver to the Engineer an additional two percent of total of each tile size, pattern, and color used on the job, for use in future repair and maintenance work. Furnish boxes of whole tiles, sealed and properly identified. Include trim shapes.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Tile: ANSI A137.1, Standard grade. Tile types, sizes, colors, and finishes shall be as indicated.
 - 1. Floor Tile: Machine-made tiles including porcelain stone, natural clay-type ceramic, or quarry floor tile of sizes, thickness, colors, and textures indicated, matching the Engineer's control samples for the location.
 - 2. Wall Tile and Base: Machine-made natural clay-type ceramic wall tile of sizes, thickness, colors, and textures indicated, matching the Engineer's control samples for the location. Provide cove base with straight top at floors where there is tile wall above and cove base with bullnose top at floors where there is no tile above.
 - 3. Trim: Include matching stops, returns, trimmers, caps, and special shapes required to produce complete, neatly finished installation. Provide cove base at intersection of floors and walls. Tops of wainscots shall have bullnose shape.

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- B. Marble Thresholds: Saddle-type thresholds of profile and dimensions indicated, cut accurately to correct door-opening dimensions. Marble shall be a white or off-white, honed or polished marble appropriate for thresholds.
- C. Setting Bed and Adhesive Materials:
1. Full-Thick Portland Cement Mortar Setting Bed:
 - a. Portland Cement: ASTM C150, Type I.
 - b. Lime: ASTM C207, Type S.
 - c. Sand: ASTM C144.
 - d. Water: Clean and potable.
 - e. Proportions: In accordance with ANSI A108.1.
 - f. Bond Coat: ANSI A118.1 dry-set portland cement mortar or ANSI A118.4 latex portland cement mortar skim coat.
 2. Thinset, Dry-Set Portland Cement Mortar: ANSI A118.1.
 3. Thinset, Latex-Portland Cement Mortar: ANSI A118.4.
 4. Epoxy Adhesive: ANSI A118.3.
 5. Water-Resistant Organic Adhesive: ANSI A136.1. Water-resistant organic adhesive only shall be used for the application of wall tile over W/R gypsum board backing surfaces.
- D. Grout: ANSI A118.6, colors as indicated. If indicated colors are not available from manufacturer's standard colors, custom colors shall be provided. If colors are not indicated, colors shall be as selected by the Engineer from manufacturer's standard colors.
- E. Reinforcement: 2-inch by 2-inch mesh, 16 gage galvanized steel wire fabric.
- F. Cleavage Membrane: ASTM D2178, asphalt-impregnated glass felt, Type III - standard ply sheet, with overlap of 4 inches minimum.
- G. Sealant: Mildew-resistant urethane or silicone sealant conforming with applicable requirements of ASTM C920. Provide Grade P for joints in horizontal surfaces and Grade NS for joints in vertical surfaces. Provide for M and G uses. Sealant may be Type S or Type M as appropriate. Color shall match color of grouted joints. Include proper backer rod where indicated or required.
- H. Cementitious Backer Board: ASTM C1325 or ANSI A118.9 for use as backing for tile.

- I. Cementitious Backer Board Accessories:
 - 1. Two-inch wide glass fiber mesh tape for use over cementitious backer board in ceramic tile installation.
 - 2. Fasteners shall be non-corrosive and non-oxidizing.

PART 3 - EXECUTION

3.01 EXAMINATION OF SUBSTRATE SURFACES

- A. Examine subfloor and substrate surfaces to receive tile. Subfloor and substrate surfaces shall be firm, dry, clean, and free from defects or irregularities that may impair bond or jeopardize the quality of the work, and no tile work shall be performed over affected areas until suitable corrections have been made.
- B. Verify that work of other trades, in or behind the tile, is installed before proceeding with tilework.
- C. Confirm that metal stud spacing and gage comply with ceramic tile installation requirements.

3.02 PREPARATION

- A. Etch concrete and concrete block substrate with ten percent solution of muriatic acid as required to remove curing compounds or other substances that may interfere with proper bond of specified mortar for tile. Rinse clean with water to remove traces of acid.
- B. Seal around all openings in floors and walls, at junctions of floors and walls, and in corners and joints with sealant before installing tile.
- C. Install cementitious backer board in accordance with ANSI 108.11. Space horizontal and vertical joints and corners 1/8 inch and fill solid with dry-set or latex-portland cement mortar. Maximum variation in backing surface shall be 1/4 inch in 10 feet. Cementitious backer board shall be taped and finished smooth using glass fiber mesh tape embedded in a skim coat of mortar over joints and corners. Where waterproof membrane occurs, coordinate installation of cementitious backer board and waterproof membrane.

3.03 INSTALLATION STANDARDS

- A. Comply with the TCA Handbook for Ceramic Tile Installation methods specified in the Contract Specifications.
- B. Comply also with ANSI A108.1, A108.4, A108.5, A108.6, and A108.10 as applicable for the indicated installation.
- C. Comply with manufacturer's instructions and recommendations for special requirements not covered by referenced standards.

3.04 INSTALLATION

- A. Lay out tilework in patterns indicated using field tile and trim shapes as indicated or required. Center tile fields in both directions in each space or on each wall area, and adjust to minimize tile cutting. Provide uniform joint widths of 1/16 inch, unless otherwise indicated.
- B. Cut field tile, not trim shapes, unless otherwise indicated.
 - 1. Avoid cutting tile but, if necessary, use a power-operated abrasive saw. Finish cut edges of tile with a carborundum stone to match the uncut edges.
 - 2. Tiles which are cut to permit the passage of another element through the finished surface are to fit it neatly around such penetration, not less than 3/8 inch nor more than 1/2 inch from such penetration. Make templates as required. Use power operated wetsaws, bandsaws, and core drills as required.
- C. Tile floors shall be in true planes, sloped a minimum of 1/8 inch per foot to floor drains. Waves or depressions in floors will not be accepted. Tile walls shall be in true planes, plumb and level. Tile joints in floors and walls shall line up. Tile out of line or out of plane will not be accepted.
- D. Extend tilework into recesses and under equipment and fixtures in the spaces indicated or scheduled to receive tile. Form a complete covering without interruptions. Terminate work neatly at obstructions, edges, and corners, without disruption of pattern or joint alignments.
- E. Provide expansion joints in tilework where indicated. Provide sealant and backer rod as required. Joints shall coincide with building expansion joints where they occur, and shall penetrate the tile setting bed completely.
- F. Install cleavage membrane over concrete or masonry surfaces where indicated or required.
- G. Install metal reinforcement in full-thick mortar setting bed for floor tile where indicated or required.

3.05 GROUTING

- A. Comply with applicable requirements of ANSI A108.10. Force a maximum of grout into all joints. Grouted joints shall be full and integral with setting bed. Before grout sets, strike or tool the joints of cushion-edge tile to depth of cushion, filling all gaps or skips, and with square-edge tile, fill joints flush with their surface, tooling joints smooth and dense.

3.06 TOLERANCES

- A. The finished work shall not exceed the following deviations from level and plumb, and from elevations, locations, slopes, and alignments indicated:
 - 1. Floors: 1/8 inch in 8 feet in any direction; plus or minus 1/8 inch at any location; 1/32 inch offset at any location.
 - 2. Walls: 1/8 inch in 8 feet in any direction; plus or minus 1/8 inch at any location; 1/32 inch offset at any location.

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3. Joints: Nominal 1/16-inch standard joint width, plus or minus 1/32-inch variation at any location; 1/16 inch in 8 feet for deviation from the plumb, and for other variations in alignment of joints.

3.07 FIELD QUALITY CONTROL

- A. Provide quality control checks of completed tilework by tapping (or sounding) tile surfaces with a soft wood or rubber mallet to detect individual tiles which are not properly bedded or bonded.

3.08 CLEANING

- A. After grout has set, sponge and wash tiles thoroughly and then polish with clean, dry cloths. Use no acids or abrasive soaps on tile, except as approved by the tile manufacturer. Tile having stains or discoloration that are not removable with soap and clean water shall be replaced.
- B. In addition to the initial cleaning procedure required, and not more than two days before final acceptance of this work, provide a final cleaning and polishing of ceramic tilework as recommended by the tile manufacturer.

3.09 PROTECTION OF COMPLETED WORK

- A. Close spaces in which tile is being set to traffic and other work; keep closed until firmly set. Protect from damage until Contract acceptance by the District. Before traffic is permitted on tile floors, cover floors with nonstaining building paper. Lay board walkways on floors that are to be used as passageways by workers. Remove cracked, broken or damaged tile; replace with new tile.

END OF SECTION 09 30 00

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Ceiling suspension system.
- B. Acoustical ceiling panels.
- C. Access system.

1.02 RELATED SECTIONS

- A. Coordinate the work of this Section for above-ceiling ductwork and for ceiling-mounted air diffusers.
- B. Coordinate the work of this Section with the work for above-ceiling electrical conduits and raceways and for ceiling-mounted lighting fixtures and speaker boxes.

1.03 MEASUREMENT AND PAYMENT

- A. General: Acoustical panel suspended ceilings will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C635 Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
 - 2. ASTM C636 Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
- B. Federal Specifications (FS):
 - 1. SS-S-118 Sound Controlling (Acoustical) Tiles and Panels
- C. International Conference of Building Officials, Uniform Building Code (UBC):
 - 1. UBC Std. 25-2 Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings

1.05 QUALITY ASSURANCE

- A. Seismic Design: Details of seismic bracing shall conform with UBC Standard No. 25-2, except as indicated otherwise.

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00, Submittal Procedures and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit manufacturer's details and specifications of the ceiling suspension system, including details of anchorage to the structure above and of seismic bracing.
- C. Samples: Submit samples and product data of the acoustical panels, suspension system, and accessories. Submit suspension system in 1 foot square package with all components of the system included. Design configuration of acoustical ceiling panels requires approval of the Engineer before the ceiling panels may be purchased for this work.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Ceiling Suspension System: ASTM C635, heavy-duty, electro-galvanized steel. Type of suspension system, grid size, and finish shall be as indicated. When not indicated, provide Direct Hung Suspension System. Color of finish shall be selected by the Engineer from the manufacturer's standard colors.
- B. Acoustical Ceiling Panels: Fed. Spec. SS-S-118, Type as indicated, Class A. Light reflectance shall exceed 75 percent. Color, texture, and finish shall be as indicated. When not indicated, provide white, fissured texture acoustical panels. Acoustical ratings shall be as follows unless otherwise indicated: NRC not less than 0.60, STC not less than 35. Minimum thickness shall be 5/8 inch.
- C. Access System: Access shall be such that any panel, anywhere, can be easily removed and reinstalled. System shall be such that panels do not raise or blow out of position from a differential in air pressure.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify that conditions are satisfactory for the installation of the acoustical ceiling system. If unsatisfactory conditions exist, notify the Engineer, and do not start the installation until such conditions have been corrected.

3.02 INSTALLATION REQUIREMENTS

- A. Installation of ceiling panels shall not be started until windows and doors are installed and glazed and the air-conditioning (or heating and ventilating) system is in operation. All interior wet and dust-producing work shall be completed and dry.
- B. At completion of the Work, all surfaces of ceiling panels and suspension system shall present true, level, and plane surfaces. Deviation from a level, plane surface shall not exceed 1/8 inch at any point in the ceiling. Surfaces of suspension system and ceiling panels shall be clean and unmarred over all areas, and shall present a finished appearance in all respects.

C. Layout Requirements:

1. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
2. Items attached to or installed in ceiling panels shall be centered in panels.

3.03 INSTALLATION

- A. Installation of suspended ceilings shall conform to the applicable requirements of ASTM C636, except as otherwise indicated or required.
- B. Suspension system and acoustical ceiling panels shall be installed in accordance with the manufacturer's installation instructions and recommendations.
- C. Suspension system shall be securely hung from the structure above with No. 12 gage galvanized steel wire, spaced 4 feet on center along main T-bars. Include diagonal seismic bracing installed in accordance with UBC Std. 25-2 and approved details.
- D. Where hanger wires are next to light fixtures and air diffusers, the spacing shall be 2 feet on center. There shall be hanging wires secured to the main T-bars at the perimeters of all light fixtures and air diffusers. Light fixtures and air diffusers themselves shall be provided with safety wires as required.
- E. Hanger wires shall be securely fastened to the structure above as recommended by the manufacturer of the suspension system components and as required to meet applicable building code requirements.
- F. Acoustical lay-in ceiling panels shall be installed in the completed grid system in accordance with the manufacturer's installation instructions and recommendations.

END OF SECTION 09 51 13

BART Facilities Standards (BFS)

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SECTION 09 63 19

STONE FLOORING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Granite.
- B. Microporous sealer.
- C. Mortar for setting bed.
- D. Grout.
- E. Reinforcement.
- F. Cleavage membrane.
- G. Sealant.

1.02 RELATED SECTIONS

- A. Ceramic and quarry tile flooring and base are specified in Section 09 30 00 - Tiling.

1.03 MEASUREMENT AND PAYMENT

- A. General: Granite flooring and base will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 DEFINITIONS

- A. The words and terms used in these Specifications conform with the definitions given in ASTM C119.

1.05 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A108.1 Installation of Ceramic Tile with Portland Cement Mortar
 - 2. ANSI A108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
 - 3. ANSI A108.10 Installation of Grout in Tilework
 - 4. ANSI A118.1 Specifications for Dry-Set Portland Cement Mortar
 - 5. ANSI A118.6 Specifications for Ceramic Tile Grouts
- B. American Society for Testing and Materials (ASTM):

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1. ASTM C97 Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
2. ASTM C99 Test Method for Modulus of Rupture of Dimension Stone
3. ASTM C119 Standard Terminology Relating to Dimension Stone
4. ASTM C144 Specification for Aggregate for Masonry Mortar
5. ASTM C150 Specification for Portland Cement
6. ASTM C170 Test Method for Compressive Strength of Dimension Stone
7. ASTM C207 Specification for Hydrated Lime for Masonry Purposes
8. ASTM C615 Specification for Granite Dimension Stone
9. ASTM C920 Specification for Elastomeric Joint Sealants
10. ASTM D2178 Specification for Asphalt Glass Felt Used in Roofing and Waterproofing

1.06 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit fully detailed Shop Drawings, showing granite flooring layouts, profiles, dimensions, bedding and joint details, and connections to adjoining work.
- C. Product Data: Submit manufacturer's specifications, catalog cuts, color range of granite, data sheets, installation instructions, and maintenance instructions. Submit certified test data for granite sample recently taken from representative areas of the supplying quarry, showing compliance with minimum physical characteristics specified.
- D. Samples: Submit 12-inch-square units of granite flooring and finish specified and 12-inch finished lengths of base. Samples shall show full range of color and texture. Samples shall match the Engineer's control samples. Also, provide sample of joint treatment, including one intersecting grouted joint, using actual granite flooring mounted on plywood. Samples require approval of the Engineer before they may be used in the work.

1.07 QUALITY ASSURANCE

- A. Granite shall be supplied from quarries having adequate capacity and facilities to meet the indicated requirements. Cutting and finishing shall be performed by skilled stone masons with substantial experience and the necessary equipment.
- B. Any granite member or component showing flaws or imperfections upon receipt at the site shall be referred to the Engineer for a determination as to whether or not it will be rejected or may be patched or redressed for use in the work.

- C. Chips at edges of granite flooring or other finished members will not be acceptable. Pieces with chipped edges shall be rejected but may be cut to smaller size if appropriate for use in the work.
- D. The Engineer reserves the right to require tests of the specified physical characteristics be performed on samples taken from the area of the quarry from which the granite to be furnished is taken.
- E. Granite shall match the Engineer's control samples in all respects. Control samples require the Engineer's approval before they may be used as a standard.

1.08 FIELD MOCK-UP

- A. Requirements: Provide field mock-ups, as specified, for the Engineer's approval.
- B. Typical Floor Panel: The Contractor shall install a typical floor panel, approximately 6 feet square in an appropriate location. Mock-up shall include joint treatment and other accessories as required for a finished installation. Keep panel damp until mortar has set; dry slowly to attain true appearance of finished work. Maintain accepted panel as the standard for completed work. Provide a typical floor panel for each different type of granite flooring and floor design indicated.
- C. Acceptance: Approved typical floor panel will be used to establish acceptable minimum standards of appearance and work quality. Acceptance will be based on uniformity, color match, proper texture, and proper construction methods.

1.09 PRODUCT DELIVERY AND STORAGE

- A. Deliver materials, other than bulk materials, in manufacturer's or supplier's unopened containers fully identified with name, brand, type, grade, class, size, color, and pattern. Store materials above ground and protect from weather and damage. Store in accordance with manufacturer's or supplier's instructions.

1.10 JOB CONDITIONS

- A. Examine substrates and adjoining construction, and the conditions under which granite flooring work is to be installed, and do not proceed with the work until conditions detrimental to the proper and timely completion of this work have been corrected.
- B. Set and grout granite flooring when ambient temperature is above 50 degrees F. Do not set or grout granite flooring when ambient temperature is above 90 degrees F.

1.11 MAINTENANCE MATERIALS

- A. Upon completion of the work, deliver to the Engineer an additional two percent of total of each granite flooring size, pattern, and color used on the job, for use in future repair and maintenance work. Furnish boxes of whole flooring units, sealed and properly identified. Include trim shapes.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Granite: Flooring and base shall be granite dimension stone conforming to applicable requirements of ASTM C615, sound, durable, free of cracks, seams, and starts; free of minerals which may cause staining under the conditions of use; and conforming to the following minimum physical requirements:
1. Absorption by Weight: 0.40 percent maximum when tested in accordance with ASTM C97.
 2. Density: 160 pounds per cubic foot minimum when tested in accordance with ASTM C97.
 3. Compressive Strength: 19,000 psi minimum when tested in accordance with ASTM C170.
 4. Modulus of Rupture: 1,500 psi minimum when tested in accordance with ASTM C99.
- B. Color, Texture, and Configuration: Color of granite shall be within the range of the Engineer's control samples. Dimensions, texture, and finish of granite shall be as indicated. Provide sanitary cove for base where indicated.
- C. Trim Shapes: Include matching stops, returns, trimmers, nosings, and special shapes required to produce complete, neatly finished granite floor and base installations.
- D. Microporous Sealer: Provide a microporous sealer, as recommended by the granite tile manufacturer, for sealing the backs of granite tile units to prevent warpage and curling of the granite units after installation.
- E. Mortar for Setting Bed:
1. Cement: ASTM C150, Type I.
 2. Lime: ASTM C207, Type S.
 3. Sand: ASTM C144.
 4. Water: Clean, potable, non-alkaline.
 5. Mix: ANSI A108.1. Include ANSI A108.5 bond or skim coat, using A118.1 dry-set portland cement mortar.
- F. Grout: ANSI A118.6, colors as selected by the Engineer.
- G. Reinforcement: 2-inch by 2-inch mesh, 16 gage galvanized steel wire fabric.
- H. Cleavage Membrane: ASTM D2178, asphalt-impregnated glass felt, Type III - standard ply sheet.
- I. Sealant: Mildew-resistant urethane or silicone sealant conforming to applicable requirements of ASTM C920. Provide Grade P for joints in horizontal surfaces and Grade NS for joints in vertical surfaces. Provide for M and G uses. Sealant may be Type S or Type M as appropriate. Color shall match grouted joints. Include proper backer rod where indicated or required.

2.02 FABRICATION**A. Dimensional Tolerances:**

1. Thickness: Variation from the thickness indicated shall not exceed plus or minus 1/8 inch.
2. Face Dimension: Variation shall not exceed one fourth of the indicated joint width or 1/16 inch, whichever is greater.

B. Flatness Tolerances:

1. Determine variation from true plane by means of a 4-foot straightedge placed in any direction on the surface.
2. On polished, honed, or fine rubbed finishes, variation from a true plane shall not exceed 1/3 of the indicated joint width or 1/16 inch, whichever is greater. On thermal and sandblasted finishes, variation from a true plane shall not exceed 1/2 of the specified joint width or 3/16 inch, whichever is greater.

C. Rejection Criteria: The above-specified tolerances apply to occasional random variation in dimensions and flatness. Granite pieces which vary consistently in a manner which is detrimental to the quality of the finished work (for example, pieces which are consistently thinner than the indicated thickness or which are consistently cupped, bowed, or warped) shall be rejected even though each individual piece may be within the specified tolerances.**PART 3 - EXECUTION****3.01 EXAMINATION OF SUBSTRATE SURFACES**

- A. Examine subfloor and substrate surfaces to receive granite. Subfloor and substrate surfaces shall be firm, dry, clean, and free from defects or irregularities that may impair bond or jeopardize the quality of the work, and no paving or flooring work shall be performed over affected areas until suitable corrections have been made.

3.02 INSTALLATION

- A. Install granite flooring and base in full mortar setting bed as indicated and in accordance with applicable requirements of ANSI A108.1. Minimum thickness of mortar setting bed shall be 3/4 inch.
- B. Granite shall be cleaned and sponged with clean water just before setting. Each unit of granite shall be set level, true to line, with uniform joint widths, as indicated.
- C. All joints shall be raked out 3/8 inch in depth, cleaned, dampened, and pointed full and flush with joint mortar or grout. Conform with applicable requirements of ANSI A108.10. Joints shall be densely tooled flat at 1/16 inch below face of granite. Faces of granite shall be kept free of mortar and grout.

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- D. Provide expansion joints in granite flooring and base where indicated. Provide sealant and backer rod as required. Joints shall coincide with building expansion joints where they occur, and shall penetrate the setting bed completely.
- E. Install cleavage membrane over concrete or masonry surfaces where indicated or required.
- F. Install metal reinforcement in mortar setting bed for flooring where indicated or required.

3.03 INSTALLATION TOLERANCES

- A. Joint Arris Lines: 1/16 inch maximum variation for honed and polished finishes; 1/8 inch maximum variation for thermal finish.
- B. Joint Width: Plus or minus 1/16 inch.

3.04 PROTECTION

- A. After installation, protect granite from damage until completion and acceptance of the work by the District. Do not use lumber or other material that may stain the granite. Provide non-staining building paper and clean plywood in areas to be walked on by workers.

3.05 CLEANING

- A. Upon completion of the work, clean granite, point open joints, and replace defective work. Do not use acids, abrasive cleaners, or wire brushes.

END OF SECTION 09 63 19

SECTION 09 65 16

RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Sheet vinyl flooring.
- B. Edging strips.
- C. Base.
- D. Underlayment and floor patch.
- E. Adhesives and primers.

1.02 MEASUREMENT AND PAYMENT

- A. General: Resilient sheet flooring and base will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM E648 Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 3. ASTM E662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials
- B. Federal Specifications (FS):
 - 1. L-F-475 Floor Covering Vinyl, Surface (Tile and Roll), with Backing
 - 2. SS-W-40 Wall Base: Rubber, and Vinyl Plastic
- C. Resilient Floor Covering Institute (RFCI):
 - 1. RFCI Installation Specifications
 - 2. RFCI Wall Base

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

- B. Samples: Submit samples of sheet vinyl flooring, edge trim, resilient base, and accessories. Sheet vinyl flooring and base require approval of the Engineer before they may be purchased for this Work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sheet Vinyl Flooring: Fed. Spec. L-F-475, Type II, Grade A. Sheet vinyl flooring shall meet the following requirements:
1. Flame Spread: 25 maximum when tested in accordance with ASTM E84.
 2. Smoke Developed: 450 maximum when tested in accordance with ASTM E662.
 3. Critical Radiant Flux: 0.45 minimum when tested in accordance ASTM E648.
 4. Gage: 0.080 inch minimum.
 5. Color and Pattern: As indicated, or as selected by the Engineer from manufacturer's standards.
- B. Edging Strips: Molded vinyl, 1-1/2 inch by 1/8-inch thick, with exposed edge 1/4-rounded, in color as selected by the Engineer from manufacturer's standards.
- C. Base: Fed. Spec. SS-W-40, topset cove, solid vinyl or rubber.
1. Size: 4 inches high, unless otherwise indicated.
 2. Color: As indicated, or as selected by the Engineer from manufacturer's standards.
- D. Underlayment and Floor Patch: Floor patch and leveling compound or underlayment shall be products manufactured for the purpose as recommended by the manufacturer of the resilient flooring furnished.
- E. Adhesives and Primers: Products specified or recommended by the manufacturer of the particular resilient flooring and base furnished.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION OF SURFACES

- A. Inspection of Substrate Surfaces: Before starting the installation of resilient flooring and base, examine all surfaces on which the finish flooring and base are to be applied. Examination includes bond, moisture, and alkali testing of concrete subfloors. Any defective surfaces or conditions preventing proper execution of the work shall be corrected as required.
- B. Cleaning and Preparation of Substrate Surfaces: Subsurfaces and backing surfaces shall be dry, clean of dust, paint spots, grease, and bond breaking or curing compounds. Subsurfaces shall also be free from roughness and sharp edges to prevent protrusions and bulges after resilient

material is laid or applied. Fill all joints, cracks, and depressions in concrete slabs with specified floor patch and underlayment material. Grind down ridges and high spots flush and smooth with surrounding surfaces.

- C. **Beginning Work:** Installation shall not begin until the work of other trades in the area, including painting, has been completed.
- D. **Responsibility:** Nothing specified herein shall be construed as relieving the Contractor of any responsibility for the quality of the finished installation. Surfaces on which resilient flooring and base are to be applied shall be level and in proper condition in every respect for an acceptable installation and long life without defects.

3.02 INSTALLATION

- A. **Installation Standards:** Comply with RFCI Installation Specifications and RFCI Wall Base.
- B. **Installation Requirements:** Keep materials at a temperature of 70 degrees F or higher for at least 48 hours before using, and maintain 70 degrees F or higher room temperatures at least 3 days before, during, and after application of materials. Apply materials in accordance with the sheet vinyl manufacturer's installation instructions. Materials shall be installed only by skilled and experienced applicators authorized and approved by the manufacturer.
- C. **Sheet Vinyl Flooring:**
 1. **Installation System:** Sheet vinyl flooring shall be installed in accordance with the sheet vinyl flooring manufacturer's instructions.
 2. **Application of Adhesive:** Apply specified adhesive with a notched steel trowel to ensure an even bed of adhesive. Cross-trowel to achieve an even thickness.
 3. **Sheet Vinyl Layout:** Layout vinyl sheet to ensure minimum number of seams. Only "perfects" shall be used so that cross seams shall be kept to absolute minimum. Lay sheets firmly against adjacent sheets to minimize joints. Neatly scribe around pipes, fixtures, and equipment to form tight, hairline joints free of gaps.
 4. **Sheet vinyl at Permanent Cabinets:** Sheet vinyl flooring is not required under fixed cabinets having covered fronts and integral bottoms and which are permanently anchored to the structure.
 5. **Edging Strips:** Install edging strips wherever sheet vinyl terminates at an opening or where there is an unprotected edge. Top of strips shall be flush with top of sheet vinyl flooring.
- D. **Base:** Complete resilient flooring installation before applying base. Install base on all walls as indicated and on fronts, toe spaces, and finished backs and ends of cabinets with adhesive recommended by manufacturer of base. Apply adhesive to both wall and base and press firmly into place. Maintain top edge at true horizontal line. Toe of coved base shall contact floor for entire length. Closely butt end joints, top edge, and faces flush. Remove excess adhesive.

3.03 CLEANING, SEALING, AND PROTECTION

- A. Traffic: Until floors are well seated at least 72 hours at a maintained temperature of not less than 70 degrees F, traffic shall be kept to an absolute minimum, and fixtures, equipment, trucks, and similar equipment or vehicles shall not be permitted to travel over floors.
- B. Cleaning and Sealing: Just before turning finished spaces over to the Engineer, and not before, clean resilient flooring and base thoroughly in accordance with the flooring manufacturer's recommendations. After cleaning, apply one coat of approved non-skid finish to floors and polish with a mechanical buffer.
- C. Protection: Install clean plywood or board walks over clean, non-staining building paper where any traffic from other trades must pass over completed resilient floors. Maintain protection until acceptance by the District and Contract substantial completion.

END OF SECTION 09 65 16

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Resilient tile.
- B. Edging strips.
- C. Base.
- D. Underlayment and floor patch.
- E. Adhesives and primers.

1.02 MEASUREMENT AND PAYMENT

- A. General: Resilient tile flooring and base will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM E648 Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 3. ASTM E662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials
- B. Federal Specifications (FS):
 - 1. SS-T-312 Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl-Asbestos
 - 2. SS-W-40 Wall Base: Rubber, and Vinyl Plastic
- C. Resilient Floor Covering Institute (RFCI):
 - 1. RFCI Installation Specifications
 - 2. RFCI Wall Base

1.04 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

- B. Samples: Submit samples of resilient tile, resilient base, edge trim, and accessories. Resilient tile and base require approval of the Engineer before they may be purchased for this work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Tile: Fed. Spec. SS-T-312, Type IV (composition). Resilient tile shall meet the following requirements:
1. Flame Spread: 25 maximum when tested in accordance with ASTM E84.
 2. Smoke Developed: 450 maximum when tested in accordance with ASTM E662.
 3. Critical Radiant Flux: 0.45 minimum when tested in accordance with ASTM E648.
 4. Gage: 1/8 inch.
 5. Size, Color, and Pattern: As indicated, or as selected by the Engineer from manufacturer's standard colors and patterns. Color and pattern shall extend through the body of the tile.
- B. Edging Strips: Molded vinyl 1-1/2 inch by 1/8-inch thick, with exposed edge 1/4-rounded, in color as selected by the Engineer from manufacturer's standards.
- C. Base: Fed. Spec. SS-W-40, topset cove, solid vinyl or rubber.
1. Size: 4 inches high, unless otherwise indicated.
 2. Color: As indicated, or as selected by the Engineer from manufacturer's standard colors.
- D. Underlayment and Floor Patch: Floor patch and leveling compound or underlayment shall be products manufactured for the purpose as recommended by the manufacturer of the resilient flooring furnished.
- E. Adhesives and Primers: Products specified or recommended by the manufacturers of the particular resilient flooring and base furnished.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION OF SURFACES

- A. Inspection of Substrate Surfaces: Before starting the installation of resilient flooring and base, examine all surfaces on which the finish flooring and base are to be applied. Examination includes bond, moisture, and alkali testing of concrete subfloors. Any defective surfaces or conditions preventing proper execution of the work shall be corrected as required.
- B. Cleaning and Preparation of Substrate Surfaces: Subsurfaces and backing surfaces shall be dry, clean of dust, paint spots, grease, and bond breaking or curing compounds. Subsurfaces shall also be free from roughness and sharp edges to prevent protrusions and bulges after resilient

material is laid or applied. Fill all joints, cracks, and depressions in concrete slabs with specified floor patch and underlayment material.

- C. **Beginning Work:** Installation shall not begin until the work of other trades in the area, including painting, has been completed.
- D. **Responsibility:** Nothing specified herein shall be construed as relieving the Contractor of any responsibility for the quality of the finished installation. Surfaces on which resilient flooring and base are to be applied shall be level and in proper condition in every respect for an acceptable installation and long life without defects.

3.02 INSTALLATION

- A. **Installation Standards:** Comply with RFCI Installation Specifications and RFCI Wall Base.
- B. **Installation Requirements:** Keep materials at a temperature of 70 degrees F or higher for at least 48 hours before using, and maintain 70 degrees F or higher room temperatures at least 3 days before, during, and after application of materials. Apply materials in accordance with the flooring manufacturer's installation instructions. Materials shall be installed only by skilled and experienced applicators authorized and approved by the flooring manufacturer.
- C. **Resilient Tile:**
 1. **Tile Layout:** Lay out center lines in both directions of room parallel to walls. Adjust to make cut tile borders of equal width on opposite sides. Avoid using less-than-half-width tiles. Lay tile with joints aligned and without contrasting borders. Lay tile with grain running in the same direction.
 2. **Application of Adhesive:** After joints, cracks, and depressions in concrete slabs have been filled with floor patch and leveling compound, and floors have been primed (if recommended by flooring manufacturer), apply the specified adhesive with a notched steel trowel to ensure an even bed of adhesive for the tile. Cross-trowel to achieve an even thickness.
 3. **Laying of Tile:** Lay tile when adhesive has set tacky, starting at the center of the room and working toward walls. Embed each tile in adhesive with closely fitted, straight, hairline joints. Do not cut tile except at walls or obstructions. Neatly scribe around pipes, fixtures, and equipment to form tight joints free of gaps. Finished floors shall be smooth and free from buckles, cracks, breaks, waves, and projecting edges and shall fit neatly at pipes and other installations and obstructions. Remove excess adhesive.
 4. **Tile at Permanent Cabinets:** Tile is not required under fixed cabinets having covered fronts and integral bottoms and which are permanently anchored to the structure.
 5. **Edging Strips:** Install edging strips wherever tile terminates at an opening or where there is an unprotected edge. Top of strips shall be flush with top of tile.
- D. **Base:** Complete resilient flooring installation before applying base. Install base on all walls as indicated and on fronts, toe spaces, and finished backs and ends of cabinets with adhesive recommended by manufacturer of base. Apply adhesive to both wall and base and press firmly into place. Maintain top edge at true horizontal line. Toe of coved base shall contact floor for entire length. Closely butt end joints, top edge, and faces flush. Remove excess adhesive.

3.03 CLEANING, SEALING, AND PROTECTION

- A. Traffic: Until floors are well seated, at least 72 hours, at a maintained temperature of not less than 70 degrees F, traffic shall be kept to a minimum, and fixtures, equipment, trucks, and similar equipment or vehicles shall not be permitted to travel over floors.
- B. Cleaning and Sealing: Just before turning station structure or building over to the District, and not before, clean resilient flooring and base thoroughly in accordance with the flooring manufacturer's recommendations. After cleaning, apply one coat of approved non-skid finish to floors and polish with a mechanical buffer.
- C. Protection: Install clean plywood or board walks over clean, non-staining building paper where any traffic from other trades must pass over completed resilient floors. Maintain protection until acceptance by the District and Contract substantial completion.

END OF SECTION 09 65 19

SECTION 09 83 14

ACOUSTIC COATING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Spray-applied acoustical finish material.
- B. Bonding agent.

1.02 RELATED SECTIONS

- A. Precast concrete panels for acoustical barriers are specified in Section 03 40 00 – Precast Concrete.
- B. Coordinate the work of this Section with the work of Contract Specifications for Mechanical, Plumbing, Fire-Suppression and Electrical, for providing facilities for sprinkler system and plumbing system piping, and for electrical conduits as required.

1.03 MEASUREMENT AND PAYMENT

- A. General: Acoustical barriers and acoustical treatments will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 2. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
 3. ASTM E605 Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
 4. ASTM E736 Test Method of Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
 5. ASTM E759 Test Method for Effect of Deflection of Sprayed Fire-Resistive Material Applied to Structural Members
 6. ASTM E761 Test Method for Compressive Strength on Sprayed Fire-Resistive Material Applied to Structural Members
 7. ASTM E859 Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members

1.05 SUBMITTALS

- A. General: Refer to Sections 01 33 00 - Submittal Procedures, and 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit manufacturer's product data, including catalog cuts, specifications, and installation instructions.
- C. Samples: Submit sample, 8 inches by 10 inches in size, of the spray-applied acoustical finish, applied full thickness on plywood backing.
- D. Test Reports: Submit certified test reports on bond strength, compressive strength, density, and sound absorption (Noise Reduction Coefficient).

1.06 QUALITY ASSURANCE

- A. Refer to Section 01 43 00 - Quality Assurance, for applicable quality assurance requirements.
- B. Spray-applied acoustical finish shall be applied by a specialist applicator/subcontractor skilled and experienced in the type of work involved. The Contractor shall ensure that the applicator/subcontractor is licensed and approved by the acoustical material manufacturer.
- C. The Contractor shall ensure that the acoustical material manufacturer inspects and approves the concrete substrate preparation and the acoustical material application, and provides field services at no additional cost to the District.
- D. The Contractor shall make necessary arrangements with the acoustical material manufacturer to provide on-site consultation and inspection services to assure the correct substrate preparation and application of the acoustical finish material.
- E. The Contractor shall ensure that the acoustical material manufacturer's representative is present at the time any phase of the work is started and periodically as the work progresses. Spray-applied acoustical finish shall be applied only over properly prepared substrate surfaces previously approved by the material manufacturer's representative.
- F. Minimum dry thickness of the acoustical finish shall be 1 inch.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Spray-Applied Acoustical Finish Material: Heavy-duty, exterior grade, cementitious acoustical finish material, meeting the following physical performance standards:
 - 1. Dry Density: Minimum average dry density of 40 pounds per cubic foot when tested in accordance with ASTM E605.
 - 2. Compressive Strength: Minimum compressive strength of 850 psi when tested in accordance with ASTM E761.

3. Bond Strength: Minimum average bond strength of 7,200 psf when tested in accordance with ASTM E736.
 4. Surface Burning Characteristics: When tested in accordance with ASTM E84:

Flame Spread:	0
Smoke Development:	0
 5. Sound Absorption: 0.60 Noise Reduction Coefficient (NRC) at 1-inch thickness with coefficient not less than 0.19 at 250 Hz when tested in accordance with ASTM C423.
 6. Deflection: Material shall not crack or delaminate from the surface to which it is applied when tested in accordance with ASTM E759.
 7. Air Erosion: Maximum total weight loss of 0.005 gram per square foot when tested in accordance with ASTM E859.
- B. Mixing Water: Clean and potable.
- C. Bonding Agent: As recommended by the manufacturer for the type of substrate.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine concrete substrate for surfaces containing curing compounds, form coatings and oils, grease, paint, and other defects that may impair bond with the acoustical finish material.
- B. Anchors, clips, hangers, support sleeves, and other attachments required to penetrate the acoustical finish for the hanging and support of pipes, ducts, and conduits shall be in place before the acoustical finish application begins. However, actual installation of piping, ducts, and conduits shall not take place until after the acoustical finish work is completed and dry as recommended by the acoustical material manufacturer.

3.02 PREPARATION

- A. Remove form coatings and oils, dust, dirt, and any other incompatible material that may impair bond by scraping, brushing, scrubbing, or water blast as necessary.
- B. Prepare substrate surfaces by filling voids, cracks, and offsets as recommended by the acoustical material manufacturer. Remove projections that may telegraph such imperfections.
- C. Prepare and prime substrate surfaces with bonding agent recommended by the acoustical material manufacturer.
- D. Provide masking to contain overspray and drop cloths to protect floors and other surfaces below from droppings and other debris.

3.03 APPLICATION

ACOUSTIC COATING

- A. Application of the spray-applied acoustical ceiling finish shall be in accordance with the manufacturer's application instructions and recommendations.

3.04 FIELD QUALITY CONTROL

- A. The Engineer shall sample and verify the thickness and density of the acoustical ceiling finish in accordance with ASTM E605.

END OF SECTION 09 83 14

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Paint materials.
- B. Accessory materials.

1.02 DESCRIPTION

- A. The work includes the painting and finishing of exterior and interior exposed surfaces throughout the Contract, except as otherwise indicated. Surface preparation, priming, and coats of paint specified are in addition to shop priming and surface treatment specified under other Sections of the Specifications.
- B. The work includes the field painting of bare and covered pipes (including color coding in accordance with ANSI A13.1), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment except as otherwise indicated.
- C. The work includes restoration of existing painted surfaces as indicated. Extent of restoration work involving existing painted surfaces is indicated on the Contract Drawings.
- D. Paint exposed surfaces whether or not colors are designated in any schedule, except where the natural finish of the material is specifically indicated as a surface not to be painted. Where surfaces are not specifically identified, paint such surfaces the same as adjacent similar surfaces.
- E. The paint systems specified indicate the basic painting systems. Deviations within the system, such as the use of two finish coats in lieu of undercoat and finish, will be permitted only where such procedure is recommended by the paint manufacturer and approved by the Engineer.

1.03 DEFINITIONS

- A. The term "paint" as used herein means all coating systems materials, and includes primers, emulsions, enamels, stain, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.04 WORK NOT INCLUDED IN THIS SECTION

- A. Shop or Factory Primed Surfaces: Shop priming of ferrous and galvanized metal items is included under the various Sections for structural steel, metal decking, miscellaneous metal items, hollow metal work, and similar items, and shop-fabricated or factory-built mechanical and electrical equipment and accessories.
- B. Pre-Finished Items: Field finish does not include painting when factory-finishing is specified for items such as acoustical materials, finished mechanical and electrical equipment, including light fixtures and distribution cabinets. Field touch-up is required, however, in all cases where the factory finish is damaged.

PAINTING

- C. Concealed Surfaces: Painting is not required on wall or ceiling surfaces in concealed areas and generally inaccessible areas, such as foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts, and elevator shafts. Paint piping, equipment, and other such items within these areas as indicated.
- D. Nonferrous Metal Surfaces: Anodized aluminum, stainless steel, copper, and similar nonferrous metal materials will not require finish painting unless otherwise indicated or specified.
- E. Operating Parts and Labels:
 - 1. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts, and expansion joints, will not require finish painting unless otherwise indicated.
 - 2. Do not paint over code-required labels, such as UL, FM, and WH, or equipment identification, performance rating, name, or nomenclature plates.
 - 3. Do not paint automatic fire sprinkler heads.
- F. Graffiti-Resistant Coatings: Anti-graffiti coatings are specified in Section 09 96 33 - Graffiti-Resistant Coatings.
- G. Miscellaneous Surfaces: Rubber and elastomeric sealants, cementitious fireproofing, and machined surfaces of metal hardware and related fittings will not require finish painting.

1.05 MEASUREMENT AND PAYMENT

- A. General
 - 1. Paint and painting will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.
 - 2. When painting is required for surfaces which are not a part of the Architectural Work, or when there is no Architectural Work, paint and painting will be measured separately for payment by the lump sum, as indicated in the Bid Schedule of the Bid Form, and will be paid for as part of the Contract lump-sum price for painting.

1.06 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A13.1 Scheme for the Identification of Piping Systems
- B. Painting and Decorating Contractors of America (PDCA):
 - 1. "Painting and Decorating Craftsman's Manual and Textbook"
- C. Steel Structures Painting Council (SSPC):
 - 1. Steel Structures Painting Manual, Volume 2, "Systems and Specifications"

1.07 QUALITY ASSURANCE

- A. Regulatory Requirements: Paint products and solvents shall comply with the latest regulations of the Bay Area Air Quality Management District regarding regulations governing permissible content of volatile organic compounds (VOC).
- B. Quality Standards:
1. Preparation and painting work shall conform with the recommended practices and quality standards of the "Painting and Decorating Craftsman's Manual and Textbook," latest edition, published by the Painting and Decorating Contractors of America.
 2. Preparation and painting of steel surfaces shall conform with the quality standards of the SSPC Steel Structures Painting Manual, Volume 2.
 3. Paints, enamels, stains, lacquers, and varnishes shall be applied in accordance with the manufacturers' latest specifications, instructions, and recommendations.
- C. Paint Coordination:
1. Coordinate and interface the work of this Section with the various Sections specifying factory-applied finishes.
 2. Coordinate the work of this Section with the work specified under Mechanical and Electrical, for color-coding and painting of mechanical and electrical equipment, piping, conduit, ducts, and panels.
 3. Provide finish coats that are fully compatible with the prime paints used. Field-applied primers shall be supplied by the same manufacturer as the intermediate (if any) and finish coats used. Review other Sections of these Specifications in which prime paints are specified to ensure compatibility of the coating system for each of the various substrates. Provide barrier coats over incompatible primers or remove and reprime as required.
- D. Paint Manufacturer's Review: Before purchasing paint materials, review the proposed paint systems, materials, and substrates with qualified representatives of the proposed paint products manufacturer. Obtain manufacturer's concurrence of the proposed paint systems, or any recommended changes thereto, before providing product data, samples, and mock-ups specified in Articles 1.06 and 1.07 herein.

1.08 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Manufacturers' Review: Submit record of paint manufacturer's review as specified above in Article 1.05.D.
- C. Product Data:
1. Submit a complete list of all materials proposed for use, together with manufacturers' product specifications for such products.

2. No claim by the Contractor concerning the unsuitability of any material specified, or the Contractor's inability to produce first class work with such materials, will be considered unless such claim is made in writing to the Engineer before the work is started.

D. Colors and Samples:

1. Colors: The Engineer will prepare a Color Schedule with samples for guidance of the painter, and reserves the right to select, allocate, and vary colors on different surfaces throughout the station or building, subject to the limitation that not more than 20 percent of bright or deep colors will be selected.
2. Samples:
 - a. Before beginning work, prepare for approval a sample of each color, texture, and finish required. Such samples, when approved, shall constitute standards for color, texture, and finish of completed work.
 - b. Make samples 8 by 10 inches in size and upon materials corresponding with those to be finished in the station or building.
 - c. When samples are rejected, a maximum of two additional modified samples may be required, in each instance, to obtain approval.
 - d. Approved samples shall be marked for identification and shall be distributed to the Engineer and field offices as required.
 - e. Mock-up for approval of final colors shall match the approved colors and samples.

1.09 MOCK-UP FOR APPROVAL OF FINAL COLORS

- A. Final coat of paint and finish for both exterior and interior shall not be applied until the colors and textures have been approved by the Engineer. To accomplish this, the Contractor shall paint a sample panel of approximately 24 square feet of the colors and textures selected on every surface of the station or building to be painted. The Engineer will approve the sample panels or direct changes as desired.
- B. The Contractor shall be on the job and be prepared to change sample panels to colors and textures desired. The Contractor shall notify the Engineer at least three days in advance of when sample panels will be ready to receive approval.
- C. Notice shall not be given, however, until permanent fluorescent and incandescent lights are installed and in operation in the rooms or areas where the sample panels have been painted. Temporary lights at the same level and of the same type, intensity, and color as the permanent lights will be permitted for viewing of sample panels.

1.10 DELIVERY AND STORAGE

- A. Refer to Section 01 60 00 - Product Requirements, for general requirements.

- B. Deliver paint materials to the site in original, unopened packages and containers with labels intact and seals unbroken.
- C. Store materials, tools, and equipment in a locked, properly ventilated, designated storage space on the site, assigned for this purpose. Receiving, opening, and mixing of paint materials shall be performed in this storage space. Keep storage space neat, clean, and accessible at all times. Protect areas from paint spillage.
- D. Place paint-soaked or solvent-soaked rags, waste, and other materials that might constitute a fire hazard in closable metal containers and remove from the premises at the close of each day's work. Take all necessary precautions to avoid fire danger.

1.11 WEATHER AND TEMPERATURE

- A. Surfaces shall be painted only when they are free from moisture. No painting on exterior surfaces shall be performed less than 72 hours of actual drying weather after a rain, or during periods of dew or fog. Receiving surfaces shall be properly dried out before proceeding with the work.
- B. No painting shall be performed when temperature is below 40 degrees F and above 90 degrees F or when the relative humidity is above 90 percent, unless recommended otherwise in writing by the paint manufacturer.

1.12 SCAFFOLDING AND PROTECTION

- A. Furnish, maintain, and remove all scaffolding, ladders, and planks required for this work, and all drop cloths for the protection of concrete walks, floors, adjacent surfaces, prefinished materials, building fixtures, and similar surfaces.
- B. Painted and finished surfaces subject to damage or defacement due to other work in the station or building shall be properly protected and covered. The Contractor shall be responsible for damage to painted work and to that of other work caused by painting operations under this Section until final acceptance by the District.

PART 2 - PRODUCTS

2.01 PAINT QUALITY STANDARDS

- A. Paint and painter's finish shall be the highest quality products of nationally recognized manufacturers specializing in the manufacture of paint products. Minimum percent solids (MPS) required for the paint products herein specified shall be as indicated in the following example: MPS: 35.
- B. Provide primer and undercoater paints produced by the same manufacturer as the intermediate and finish coats. Use thinners approved by the paint manufacturer which meet previously referenced regulatory requirements, and provide only to recommended limits.
- C. Provide primers and undercoaters which are suitable for each surface to be painted and which are compatible with specified intermediate and finish paint coats.

PAINTING

- D. Materials necessary to complete the painting work are herein generically specified. Except as otherwise specified, materials for any one paint system shall be by the same manufacturer.
- E. Minimum dry film thicknesses (MDFT), in mils, and the number of coats required to obtain such thicknesses shall be in accordance with the paint manufacturer's application instructions and recommendations.

2.02 PAINT MATERIALS

- A. Type and Manufacture: The following products constitute the standards for the primers, intermediate, and finish coats of the paint systems herein specified in articles 3.04 and 3.05.
 - 1. Ferrous Metal Primer: Refer to Section 05 12 00 - Structural Steel Framing, and Section 05 50 00 - Metal Fabrications, for requirements.
 - 2. Galvanized Metal Primer: Refer to Section 05 50 00 - Metal Fabrications, for requirements.
 - 3. Masonry Surface Conditioner: Acrylic latex masonry filler. MPS: 35.
 - 4. Exterior Masonry Paint: Exterior 100 percent acrylic latex masonry paint. MPS: 35.
 - 5. Exterior Wood Primer: Exterior wood primer as recommended by the manufacturer for the location and conditions. MPS: 40.
 - 6. Exterior House and Trim Paint: Exterior enamelized house and trim paint for wood and metal. MPS: 40.
 - 7. P.V.A. Primer-Sealer: Polyvinyl-acetate primer-sealer for interior gypsum board (drywall). MPS: 30.
 - 8. Alkyd Primer-Sealer: Alkyd or acrylic latex primer sealer for interior plaster, concrete, masonry, and gypsum board (drywall). MPS: 30.
 - 9. Enamel Undercoat: Alkyd or acrylic latex enamel undercoater. MPS: 35.
 - 10. Semi-Gloss Enamel: Alkyd or acrylic latex enamel, semi-gloss sheen, washable. MPS: 35.
 - 11. Eggshell Enamel: Alkyd or acrylic latex enamel, eggshell sheen, washable. MPS: 35.
 - 12. Heavy-Duty Gloss Enamel: Heavy-duty, industrial grade, polyurethane, gloss sheen. MPS: 45.
 - 13. Interior Flat Latex Paint: Interior flat latex paint for drywall; not washable. MPS: 30.
 - 14. Floor Enamel: Acrylic latex floor enamel for concrete floors, semi-gloss sheen, washable. MPS: 45.
 - 15. Floor Epoxy: Waterborne epoxy polyamide. MPS: 40.

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16. Steel Bridge Epoxy Paint: High solids epoxy paint. MPS: 65.
17. Steel Bridge Polyurethane Paint: Acrylic polyurethane paint. MPS: 50.

B. Accessory Materials:

1. Shellac: ASTM D207, Type I, bleached, No. 4, cut with pure grain alcohol.
2. Thinner: As recommended by the manufacturer for the respective product.
3. Spackle or Putty: Standard commercial product manufactured for the purpose, thoroughly mixed to prevent the possibility of shrinkage. Use exterior grade for exterior Work. Spackle or putty shall be tinted toward finish color. Spackle or putty containing white lead will not be permitted for use on this Project.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES

A. New Surfaces to be Painted:

1. Painting or finishing shall not be started until the surfaces to be painted or finished are in proper condition to accept, and assure the proper adhesion and functioning of, the specified painting system in accordance with the paint manufacturer's installation instructions and recommendations. Surfaces that cannot be properly prepared by the painter for finishing shall not be painted or finished until they are corrected. All surfaces to be painted shall be clean and dry.
2. Wood surfaces shall be sandpapered and dusted clean. Knots, pitch pockets, or sappy portions shall be sealed with clean shellac or knot sealer. Spackle or putty all nail holes, cracks, and other imperfections after first or prime coat with spackle or putty of color to match finish coat. Do not seal wood surfaces to receive stain or natural finish.
3. Concrete, masonry, stucco, and plaster shall be cleaned of form oils, efflorescence, chalk, dust, and dirt, and shall be thoroughly dry or dried before painting.
4. Holes, cracks, and other imperfections in surfaces to be painted shall be suitably primed and patched with a compound recommended by the manufacturer of the paint to be applied to these surfaces, and all areas to be painted shall be brought to true, even surfaces.
 - a. Where cracks exist at transitions between existing and new materials, or in patched surfaces, such cracks shall be patched, and the patching material shall be feathered out and textured to match adjacent surfaces, so as to make the patched surface "invisible" after painting.

B. Existing Painted Surfaces to be Painted:

1. Concrete, Masonry, and Stucco Surfaces:

PAINTING

- a. Exterior concrete, masonry, and stucco surfaces shall be sandblasted by the “wet” sandblast method to remove all existing paint film from these surfaces.
 - 1) When “wet” sandblasting is not permitted by jurisdictional authority, surfaces shall be selectively power wire-brushed to remove loose and defective existing paint film. Edges of removed paint film shall be feathered out to conceal such edges in the finished work.
 - b. Surfaces not to be sandblasted shall be properly masked and otherwise protected to preclude damage to these surfaces.
 - c. Protection of the public and adjacent buildings from the residue of sandblasting operations shall be provided in accordance with the requirements of the jurisdictional authority.
2. Wood Surfaces: All wood surfaces shall be power sanded as required to remove all peeling, flaking, blistering, loose, or otherwise defective existing paint surfaces.
 3. Metal Surfaces: Immediately proceeding power-tool cleaning, pressure wash and rinse existing painted metal surfaces. Where access problems or the likelihood of damaging adjacent surfaces exist, wash and rinse. Existing painted metal surfaces shall be power-tool cleaned in accordance with SSPC-SP 3 to remove loose and defective paint surfaces, and then feathered smooth. Rust shall be completely removed. For steel bridges, clean in accordance with SSPC-SP 6 or SSPC-SP 10. Then solvent clean surfaces in accordance with SSPC-SP 1 to remove dust, and apply prime coat of Ferrous Metal Primer or Galvanized Metal Primer, as applicable, to existing surfaces as herein specified in Articles 3.04 and 3.05.

C. Hardware and Fixtures:

1. Hardware, hardware accessories, plates, lighting fixtures, and similar items in place shall be removed prior to painting and replaced upon completion of each space.
2. Heating and other equipment adjacent to walls shall be disconnected, using workers skilled in appropriate trades, and moved to permit wall surfaces to be painted. Following completion of painting, they shall be expertly replaced and reconnected.

D. Exposed Plumbing, Mechanical, and Electrical Items:

1. Items without factory finish such as conduits, pipes, ducts, grilles, registers, vents, access panels, and items of similar nature shall be finished to match adjacent wall and ceiling surfaces, unless otherwise directed. Paint visible surfaces behind vents, registers, and grilles flat black.
2. Wash exposed metal with solvent, prime, and paint as scheduled or specified. Spray paint wherever practicable. Do not paint concealed conduits, piping, and ducts.

3.02 PAINT PERFORMANCE AND FIELD QUALITY ASSURANCE

PAINTING

- A. Painting shall be performed by skilled and experienced painters, working under the supervision of a capable supervisor. Materials shall be thinned only for proper workability and in compliance with the manufacturer's specifications.
- B. Paint material shall be evenly brushed or smoothly flowed on without runs or sagging, and free from drops, ridges, laps, and brush marks. Assure that all coats are thoroughly dry before applying succeeding coats. Sand surfaces between coats as necessary to produce a smooth finish and as may be required for adhesion of succeeding coats.
- C. Priming or painting of wood will not be permitted on or in the station or building where concrete, masonry, or plaster is in the process of installation or application, or in the process of drying.
- D. Putty, calking, or spackle shall be applied after surface is primed and primer is dry.
- E. Interior surfaces shall not be painted until concrete, masonry, and plaster surfaces in the station or building have completely cured and have stabilized moisture content in accordance with the paint manufacturer's recommendations.
- F. Finish coats of paint shall not be applied on the interior of the station or building until the interior spaces are completely closed-in with windows and doors in place and glazed, until all interior wet and dust-producing work is complete and dry, and until the heating and ventilating system (or air-conditioning system) is in operation.

3.03 PAINT SYSTEMS

- A. Provide three-coat work (unless otherwise specified), consisting of prime coat, intermediate coat, and finish coat, in texture and color as selected and approved by the Engineer.
- B. Exterior paint systems are specified and identified herein by letter and interior paint systems by number, and the systems specified correspond to the finishes indicated on the Contract Drawings.
- C. The herein specified paint systems indicate the minimum dry mil film thickness (MDFT) required for the particular paint system. Paint shall be applied at the manufacturer's recommended rate to achieve the proper MDFT specified. If a manufacturer normally does not utilize an intermediate coat in its paint system to achieve the specified MDFT, then the intermediate coat may be omitted.

3.04 EXTERIOR PAINTING

- A. Paint System "A" - Paint Finish on Concrete, Masonry, and Stucco:

Prime Coat: Masonry Surface Conditioner, tinted toward finish color.
Intermediate Coat: Exterior Masonry Paint.
Finish Coat: Exterior Masonry Paint.
MDFT: 6.

- B. Paint System "B" - Paint Finish on Ferrous and Galvanized Metal:

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Prime Coat: For new ferrous metal: Field-apply Ferrous Metal Primer. For shop primed ferrous metal: Apply touchup primer. For galvanized metal: Galvanized Metal Primer touchup. For existing ferrous and galvanized metal: Rust-inhibitive primer as recommended by manufacturer of finish coats.

Intermediate Coat: Heavy-Duty Gloss Enamel.

Finish Coat: Heavy-Duty Gloss Enamel.

MDFT: 6.

C. Paint System "C" – Paint Finish on Wood:

Prime Coat: Factory-primed (new surfaces). Exterior Wood Primer (existing surfaces).

Intermediate Coat: Exterior House and Trim Paint.

Finish Coat: Exterior House and Trim Paint.

MDFT: 7.

D. Paint System "D" – Paint Finish on Steel Bridges:

Prime Coat: As specified in Article 2.04B in Section 05 12 00 Structural Steel Framing.

Intermediate Coat: Steel Bridge Epoxy Paint.

Finish Coat: Steel Bridge Polyurethane Paint.

MDFT: 11.

3.05 INTERIOR PAINTING

A. Paint Systems:

1. Paint System "1" - Flat Finish on Gypsum Wallboard:

Prime Coat: P.V.A. Primer-Sealer, tinted toward finish color.

Intermediate Coat: Interior Flat Latex Paint.

Finish Coat: Interior Flat Latex Paint.

MDFT: 5.

2. Paint System "2" - Eggshell Finish on Gypsum Wallboard:

Prime Coat: P.V.A. Primer-Sealer.

Intermediate Coat: Alkyd Primer-Sealer, tinted toward finish color.

Finish Coat: Eggshell Enamel.

MDFT: 5.

3. Paint System "3" - Semi-Gloss Finish on Gypsum Wallboard:

Prime Coat: P.V.A. Primer-Sealer.

Intermediate Coat: Alkyd Primer-Sealer, tinted toward finish color.

Finish Coat: Semi-Gloss Enamel.

MDFT: 5.

4. Paint System "4" - Flat Finish on Concrete, Masonry, and Plaster:

PAINTING

Prime Coat: Alkyd Primer-Sealer.
Intermediate Coat: Interior Flat Latex Paint.
Finish Coat: Interior Flat Latex Paint.
MDFT: 5.

5. Paint System "5" - Eggshell Finish on Concrete, Masonry, and Plaster:

Prime Coat: Alkyd Primer-Sealer.
Intermediate Coat: Alkyd Primer-Sealer, tinted toward finish color.
Finish Coat: Eggshell Enamel.
MDFT: 5.

6. Paint System "6" - Semi-Gloss Finish on Concrete, Masonry, and Plaster:

Prime Coat: Alkyd Primer-Sealer.
Intermediate Coat: Alkyd Primer-Sealer, tinted toward finish color.
Finish Coat: Semi-Gloss Enamel.
MDFT: 5.

7. Paint System "7" - Paint Finish on Metal:

Prime Coat: Factory Prime Coat and field-applied Ferrous Metal Primer or Galvanized Metal Primer touchup, as applicable.
Intermediate Coat: Enamel Undercoat Enamel, tinted toward finish color.
Finish Coat: Semi-Gloss Enamel.
MDFT: 5.

8. Paint System "8" - Paint Finish on Woodwork and Trim:

Prime Coat: Shop Prime Coat or Enamel Undercoat, as applicable.
Intermediate Coat: Semi-Gloss Enamel, tinted toward finish color.
Finish Coat: Semi-Gloss Enamel.
MDFT: 5.

9. Paint System "9" - Paint Finish on Wood Shelves:

Prime Coat: Enamel Undercoat.
Finish Coat: Semi-Gloss Enamel.

For all exposed wood shelves in closets, Janitor's Rooms, and any other rooms or areas as indicated.

10. Paint System "10" - Paint Finish on Metal Handrails and Railings:

Prime Coat: Factory Prime Coat and field-applied Ferrous or Galvanized Metal Primer touchup, as applicable.
Intermediate Coat: Enamel Undercoat, tinted toward finish color.
Finish Coat: Heavy-Duty Gloss Enamel.
MDFT: 6.

PAINING

11. Paint System "11" - Paint Finish on Concrete Floors, Steps, and Risers:

Prime Coat: Floor Enamel, thinned as recommended by paint manufacturer.
Finish Coat: Floor Enamel.
MDFT: 4.5.

12. Paint System "12" - Paint Finish on Elevator Machine Rooms Floors and at Elevator Pits:

Two Coats: Floor Epoxy.
MDFT: 4 total.

3.06 CLEANING

- A. Clean and retouch the work as necessary for a first-class job. All surfaces of the station or building and surrounding areas shall be left clean and neat in all respects, free from any paint spots, smears, smudges, or stain.

END OF SECTION 09 91 00

SECTION 09 96 33

GRAFFITI-RESISTANT COATINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Graffiti-resistant coatings.

1.02 MEASUREMENT AND PAYMENT

- A. General: Graffiti-resistant coatings will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.03 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Samples: Submit samples of stone, masonry, and concrete (as proposed for the project), 8 inches by 10 inches in size, of the prime and finish coatings.
- C. Manufacturer's Data: Submit manufacturer's product data, including coatings' analysis and performance, and application instructions. Include manufacturer's recommended graffiti-removal procedures and products.

1.04 QUALITY ASSURANCE

- A. VOC Regulations: Graffiti-resistant coatings shall comply with the Bay Area Air Quality Management District regulations governing permissible content of volatile organic compounds (VOC).
- B. Manufacturer's Qualifications: Graffiti-resistant coatings shall be furnished by a manufacturer specializing in the manufacture of graffiti-resistant coatings.
- C. Applicator's Qualifications: Graffiti-resistant coatings shall be applied by a licensed applicator approved by the manufacturer who furnishes the materials.
- D. Coating Manufacturer's Approval and Job Service:
 - 1. Contractor shall provide the graffiti-resistant coating manufacturer's field services for inspection and approval of coating applications.
 - 2. The Contractor shall make all necessary arrangements with the coating manufacturer to provide on-site consultation and inspection services to ensure the proper application and completion of the graffiti-resistant coatings system.
 - 3. The coating manufacturer's representative shall be present at the time any phase of the work is started. Graffiti-resistant coatings shall be applied only over surfaces previously approved by the coating manufacturer's representative.

1.05 MOCK-UP

- A. Before beginning coatings' applications, provide sample mockup applications, measuring 3 feet by 4 feet each, at inconspicuous locations, on each different substrate. Coordinate mockup location with the Engineer for the Engineer's review and testing.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the project site in new, unopened containers with the following information: manufacturer's name, product data, and application instructions.
- B. Store materials and equipment in a properly ventilated, designated storage space on the site. Temperature of storage area shall not be less than 45 degrees F and shall not exceed 90 degrees F.

1.07 SITE CONDITIONS

- A. Apply coatings only when the temperature of surfaces to receive coatings and surrounding air temperatures are between 50 degrees and 90 degrees F, unless otherwise permitted by the coating manufacturer's printed instructions.
- B. Do not apply coatings during periods of fog, mist, and rain, or when rain is imminent.

PART 2 - PRODUCTS

2.01 GRAFFITI-RESISTANT COATINGS

- A. Graffiti-resistant coatings, base or prime coat and finish coats, shall be a two-component, polymer-based, non-sacrificial product. The finished coating shall be stable, colorless, transparent, low sheen (satin or flat), water soluble product.
- B. Coatings shall be weather and rain resistant, abrasive resistant, peel resistant, ultra-violet resistant, non-yellowing, and shall permit moisture vapor relief.
- C. Graffiti-resistant coatings shall have the capability of having all types of paints and graffiti materials completely removed without damaging the uncoated surfaces to which they are applied. Coatings which require re-application in areas which have been repeated cleaned will be acceptable. Re-application shall not require removal of coating.
- D. Products required to remove graffiti from the coating shall be non-toxic and shall comply with the herein referenced VOC Regulations. Removal of graffiti shall cause no damage or change in the appearance of the treated surface.
- E. Coatings shall be products manufactured specifically for protection of surfaces against graffiti vandalism. Products require review and approval by the Engineer before they may be purchased for use in the work.

PART 3 - EXECUTION

3.01 CONDITION OF SUBSTRATE

- A. Examine the areas and conditions under which graffiti-resistant coating work is to be performed.
- B. Do not apply coating system over surface contaminants, such as dust, dirt, form oils, and loose substrate.
- C. Verify pH of concrete or masonry substrate is within coating manufacturer's requirements using test method acceptable to coating's manufacturer. Any action required to ensure pH of substrate is acceptable, including delaying application until substrate has further cured, shall be the responsibility of the Contractor.

3.02 COATINGS PREPARATION AND MIXING

- A. Prepare and mix materials in accordance with the coating manufacturer's instructions and recommendations.
- B. Remove any skins that form on surface of material prior to moving containers, mixing, or using.
- C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.03 APPLICATION

- A. Prepare surfaces and apply coatings in accordance with the coating manufacturer's application instructions and recommendations. Apply coatings in thickness and sequence of coats as recommended by the coating manufacturer.

END OF SECTION 09 96 33

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5.10 Division 10

Specialties

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SECTION 10 21 14

METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Toilet compartments.
- B. Urinal screens.

1.02 MEASUREMENT AND PAYMENT

- A. General: Metal toilet partitions and urinal screens will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.03 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Show compartment and urinal screen layouts, swing of doors, elevations, anchorage and installation details, components, hardware, accessories, finishes, and relevant dimensions.
- C. Product Data: Submit manufacturer's product data of specified toilet compartments and urinal screens.

PART 2 - PRODUCTS

2.01 TOILET COMPARTMENTS

- A. Compartment Type: Toilet compartments shall be manufactured from Type No. 304 stainless steel with No. 4 finish and shall be of the following types as indicated:
 - 1. Floor Supported and Headrail Braced Units: Floor-anchored pilasters with pilasters connected and reinforced by headrail bracing, and wall-mounted partition panels.
 - 2. Floor Supported Units: Floor-anchored pilasters and wall-mounted partition panels.
 - 3. Ceiling Supported Units: Ceiling hung pilasters anchored to concealed, above-ceiling structural members, and wall-mounted partition panels.
- B. Doors: Flush panel, one-inch thick, with two sheets of minimum 22 gage stainless steel sheet, bonded under pressure to both surfaces of manufacturer's standard core material. Formed edges shall be welded every 18 inches and sealed with a surrounding oval-crown, polished stainless steel locking strip that is mitered, welded and finished at the corners.
- C. Panels: Flush panel, one-inch thick of same materials and construction as specified for doors, with insulating core material.

- D. Pilasters: Flush panel, 1-1/4 inches thick, with two sheets of minimum 18 gage stainless steel sheet, constructed welded, and finished as specified for doors.
- E. Installation Accessories: Provide all fittings, fasteners, and installation hardware as required for a complete and finished installation. Anchorage and installation accessories shall be stainless steel and shall be concealed and made vandal-proof with the installation of stainless steel trim plates secured with theft-proof bolts. Stirrup brackets used to attach panels and pilasters shall be heat-treated, polished, clear anodized aluminum.
- F. Hardware: Hardware shall consist of standard type gravity hinge which allows the door to remain open at any angle, heavy latch with combination keeper and rubber-faced strike, and coat hook with rubber bumper. Hardware shall be stainless steel or chrome-plated alloy as noted herein, manufactured or furnished by the manufacturer of the toilet partitions. Hardware shall include the following features and accessories:
 - 1. Each door shall be equipped with chrome-plated, cast alloy coat hook and bumper, concealed latch with stainless steel bolt permitting exterior access, one-piece chrome-plated stop and keeper, and concealed controlled power bearing gravity hinge.
 - 2. Door shall be adjustable to permit rest position at any angle within a 270-degree arc and the weight shall be carried by a thrust bearing with all moving parts concealed within door thickness.
 - 3. Top hinge pin shall be secured at three points with stainless steel door hinge fittings fully flush with face plates of door.
 - 4. Pilaster hinge brackets shall be of stainless steel alloy and factory mounted flush to pilaster.
 - 5. Fasteners shall be stainless steel unless approved by District Representative.

2.02 URINAL SCREENS

- A. Urinal screens shall be manufactured from Type 304 stainless steel of same materials and construction as herein specified for doors, and shall be furnished complete with all fittings, fastenings, and anchorage devices as required for a complete installation.
- B. Urinal screens shall be flush panel, wall-mounted with brackets or floor-supported with pilasters as indicated. Urinal screens shall be 18 inches in width for wall-mounted screens and 24 inches in width for floor-supported screens.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Toilet compartments and urinal screens shall be installed as indicated by the manufacturer or its authorized representative in accordance with the manufacturer's installation instructions and recommendations. Install toilet compartments and urinal screens in a rigid and substantial manner, straight and plumb, with all horizontal lines level.

- B. Pilaster anchors shall be carried through finish floor materials and secured to concrete structural slab for floor-supported units, and through finish ceiling materials and secured to above-ceiling structural supports for ceiling-supported units, as indicated, with shoes and adjustable anchors.
- C. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work. Adjust pilaster shoes to fit flush against the floor and ceiling, as applicable. Clearance at walls shall be approximately 1/2 inch. Clearance at vertical edges of doors shall be uniform from top to bottom and shall not exceed 3/16-inch.

3.02 ADJUSTMENTS

- A. Adjust and lubricate hardware for proper operation after installation and just prior to final inspection. Adjust door hardware so that doors are free of hinge bind.
- B. Adjust hinges on in-swinging doors to hold doors open approximately 30 degrees from the closed position when unlatched. Adjust hinges on out-swinging doors to return doors to the fully open position (90 degrees) when doors are adjacent to walls, and to hold doors open approximately 15 degrees at intermediate locations.

3.03 COMPLETION

- A. After completion of installation, remove protective maskings; clean and polish exposed surfaces of compartments and urinal screens, hardware, fittings, and accessories.
- B. When complete, each compartment and urinal screen shall be square, plumb and level, accurately aligned, and securely anchored. Doors shall remain plumb in all positions of swing, and doors and hardware shall operate smoothly, quietly, and free from binding. Exposed surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, and other defects and damage.

END OF SECTION 10 21 14

BART Facilities Standards (BFS)

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SECTION 10 21 15

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Toilet compartments.
- B. Urinal screens.

1.02 RELATED SECTIONS

- A. Structural members for ceiling supported units are specified in Section 05 12 00 - Structural Steel Framing, and Section 05 50 00 - Metal Fabrications. Coordinate installation and anchorage requirements with the foregoing specified Division 5 Sections.

1.03 MEASUREMENT AND PAYMENT

- A. General: Plastic toilet compartments will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.04 SUBMITTALS

- A. General: Refer to Contract Specifications Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Show compartment and urinal screen layouts, swing of doors, elevations, anchorage and installation details, components, hardware, accessories, finishes, and relevant dimensions.
- C. Product Data: Submit manufacturer's product data of specified toilet compartments and urinal screens, including color charts for color selection.

PART 2 - PRODUCTS

2.01 TOILET COMPARTMENTS

- A. Plastic Material: Partition panels, pilasters, and doors, and urinal screens shall be manufactured from high-density polymer resins which are waterproof, non-absorbent, and have a self-lubricating surface that resists markings from pens, pencils, and other writing instruments. Selected color shall extend uniformly throughout the body of the plastic panels.
- B. Compartment Type: Toilet compartments shall be of the following types as indicated:
 - 1. Floor Supported and Headrail Braced Units: Floor-anchored pilasters with pilasters connected and reinforced by headrail bracing, and wall-mounted partition panels.
 - 2. Floor Supported Units: Floor-anchored pilasters and wall-mounted partition panels.

3. Ceiling Supported Units: Ceiling hung pilasters anchored to concealed, above-ceiling structural members, and wall-mounted partition panels.
- C. Doors, Panels, and Pilasters: Flush panel, one-inch thick, solid homogeneous color as selected, with smooth rounded edges.
 - D. Installation Accessories: Provide all fittings, fasteners, and installation hardware as required for a complete and finished installation. Anchorage and installation accessories shall be 300 series stainless steel and shall be concealed and made vandal-proof with the installation of stainless steel trim plates secured with theft-proof bolts. Stirrup brackets used to attach panels and pilasters shall be heat-treated, polished, clear anodized aluminum.
 - E. Hardware: Hardware shall consist of standard type gravity hinge which allows the door to remain open at any angle, heavy latch with combination keeper and rubber-faced strike, and coat hook with rubber bumper. Hardware shall be stainless steel or chrome-plated alloy as noted herein, manufactured or furnished by the manufacturer of the toilet partitions. Hardware shall include the following features and accessories:
 1. Each door shall be equipped with chrome-plated, cast alloy coat hook and bumper, concealed latch with stainless steel bolt permitting exterior access, one-piece chrome-plated stop and keeper, and concealed controlled power bearing gravity hinge.
 2. Door shall be adjustable to permit rest position at any angle within a 270-degree arc, and the weight shall be carried by a thrust bearing with all moving parts concealed within door thickness.
 3. Partition hardware, including hinge pins, shall be 300 series stainless steel. The hardware shall be specifically designed for use with polymer resins panels.
 4. Fasteners shall be stainless steel, tamper-resistant.

2.02 URINAL SCREENS

- A. Urinal screens shall be manufactured from polymer resins of same materials and construction as herein specified for partition panels, and shall be furnished complete with all fittings, fastenings, and anchorage devices as required for a complete installation.
- B. Urinal screens shall be flush panel, wall-mounted with brackets or floor-supported with pilasters as indicated. Urinal screens shall be 18 inches in width for wall-mounted screens and 24 inches in width for floor-supported screens.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Toilet compartments and urinal screens shall be installed as indicated by the manufacturer or its authorized representative in accordance with the manufacturer's installation instructions and recommendations. Install toilet compartments and urinal screens in a rigid and substantial manner, straight and plumb, with all horizontal lines level.

- B. Pilaster anchors shall be carried through finish floor materials and secured to concrete slab for floor-supported units, and through finish ceiling materials and secured to above-ceiling structural supports for ceiling-supported units, as indicated, with shoes and adjustable anchors. Anchors require specific approval by the Engineer before they may be used in post-tensioned slabs, beams, and girders.
- C. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work. Adjust pilaster shoes to fit flush against the floor and ceiling, as applicable. Clearance at walls shall be approximately 1/2 inch. Clearance at vertical edges of doors shall be uniform from top to bottom and shall not exceed 3/16-inch.

3.02 ADJUSTMENTS

- A. Adjust and lubricate hardware for proper operation after installation and just prior to final inspection. Adjust door hardware so that doors are free of hinge bind.
- B. Adjust hinges on in-swinging doors to hold doors open approximately 30 degrees from the closed position when unlatched. Adjust hinges on out-swinging doors to return doors to the fully open position (90 degrees) when doors are adjacent to walls, and to hold doors open approximately 15 degrees at intermediate locations.

3.03 COMPLETION

- A. After completion of installation, remove protective maskings; clean exposed surfaces of compartments and urinal screens, hardware, fittings, and accessories.
- B. When complete, each compartment and urinal screen shall be square, plumb and level, accurately aligned, and securely anchored. Doors shall remain plumb in all positions of swing, and doors and hardware shall operate smoothly, quietly, and free from binding. Exposed surfaces shall be clean and free from scratches, dents, tool marks, stains, discoloration, and other defects and damage.

END OF SECTION 10 21 15

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SECTION 10 22 13

WIRE MESH PARTITIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wire mesh partitions and ceiling.
- B. Doors.

1.02 MEASUREMENT AND PAYMENT

- A. General: Wire mesh partitions and ceiling will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.03 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data and Samples, for submittal requirements and procedures.
- B. Shop Drawings: Submit detailed Shop Drawings of the wire mesh partitions and ceiling, including installation details, door, hardware, and accessories.
- C. Product Data: Submit manufacturer's product data and specifications of the specified wire mesh partitions.
- D. Samples: Submit a 12-inch by 12-inch wire mesh panel constructed of specified frame members and wire mesh.

PART 2 - PRODUCTS

2.01 WIRE MESH PARTITIONS AND CEILING

- A. Wire Mesh: Crimped, 10 gage steel wire woven into a 1-1/2-inch square-pattern mesh or diamond-pattern mesh, as indicated, securely clinched to frame members.
- B. Frame Members: 1-1/2-inch by 3/4-inch cold-rolled steel channels with 3/16-inch bolt holes approximately 24 inches on center.
- C. Horizontal Reinforcing Members: 1-1/2-inch by 3/4-inch by 1/8-inch cold-rolled steel channel with wire woven through, or two 1-inch by 1/2-inch channels bolted or riveted toe-to-toe through mesh, and secured to vertical members. Provide number of horizontal reinforcing members to suit panel height as recommended by partition manufacturer for the proposed usage.
- D. Stiffening Bars: Provide flat bar stiffener posts between abutting panel frames. Size as recommended by partition manufacturer for partition height required. Increase size of stiffening bars, if required, to maintain partition rigidity.
- E. Top Capping Bars: 3-inch by 4.1-pound channel secured to top framing channel with 1/4-inch "U" bolts spaced not more than 28 inches on center.

- F. Floor Shoes: Cast metal, sized to suit vertical framing and to provide approximately 6 inches clear space between finished floor and bottom horizontal frame members. Furnish units with set screw for leveling adjustment.

2.02 DOORS

- A. Provide hinged door or sliding door, as indicated, meeting the following requirements:
1. Hinged Door: Door frame of 1-1/4-inch by 3/4-inch by 1/8-inch steel channel with 1-1/4-inch by 1/8-inch flat bar cover on three sides, and 1-3/8-inch by 3/4-inch by 1/8-inch angle riveted to the lock side. Door shall have 1-1/2 pair of butt hinges riveted to both door and hinge bar. Door shall have mortise-type cylinder lock operated by key outside with recessed knob inside.
 2. Sliding Door: Door frame of 1-1/2-inch by 3/4-inch by 1/8-inch channel with 1-1/2-inch by 1/8-inch flat bar cover plate on all sides, and 1/8-inch-thick strike bar on lock side. Provide two four-wheel roller-bearing hangers, box track, and bottom guide channel, and mortise-type cylinder lock operated by key outside with recessed knob inside. Align bottom of door with bottom of adjacent panels.
 3. Lock Cylinders: Cylinders for locks are specified in Contract Specifications Section 08 71 00 - Door Hardware.

2.03 FABRICATION

- A. Do not provide components less than sizes indicated. Provide larger size components when recommended by partition component manufacturer for the proposed usage.
- B. Provide anchorage devices, hardware, and installation accessories as required for a complete installation.
- C. Provide manufacturer's standard galvanized finish for wire mesh, framing, and doors.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Wire mesh partitions and ceiling shall be installed as indicated and in accordance with the approved Shop Drawings and the manufacturer's installation instructions and recommendations.
- B. Erect partitions plumb, rigid, properly aligned, and securely anchored and fastened in place, complying with the manufacturer's recommendations for the proposed usage.
- C. Provide additional field bracing as necessary for rigid, secure, and seismically braced installation. Provide additional clips and bracing as required.

3.02 ADJUST AND CLEAN

- A. Adjust doors for smooth operation without binding.

WIRE MESH PARTITIONS

- B. Touch up damaged finish after completion of installation, using field-applied touch-up cold galvanizing compound to match color of galvanizing.

END OF SECTION 10 22 13

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SECTION 10 28 24

TOILET AND JANITORIAL ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Seat cover dispensers.
- B. Sanitary napkin disposal.
- C. Towel dispensers.
- D. Toilet roll and tissue dispenser.
- E. Stainless steel shelf and clothes rod.

1.02 RELATED SECTIONS

- A. Backing plates, blocking, and reinforcement as required for the mounting of accessory items on or in partitions, walls, or shafts, framed with heavy gage steel members, are specified in Contract Specifications Section 05 40 00 - Cold-Formed Metal Framing, as applicable.
- B. Fire-Retardant treated wood blocking and backing, where appropriate and acceptable, are specified in Contract Specifications Section 06 10 00 - Rough Carpentry.
- C. Backing plates, blocking, and reinforcement as required for the mounting of accessory items on or in partitions, walls, or shafts, framed with light gage sheet metal members, are specified in Contract Specifications Section 09 22 00 - Supports for Plaster and Gypsum Board, as applicable.

1.03 MEASUREMENT AND PAYMENT

- A. General: Toilet and bath accessories will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A153/A153M Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - 3. ASTM A269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

4. ASTM C1002 Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases

1.05 SUBMITTALS

- A. Refer to Contract Specifications Sections 01 33 00 - Submittal Procedures, and 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submit manufacturer's product data illustrating each accessory item at large scale. Include manufacturer's installation details.
- C. Submit one sample of each different accessory item specified to be used in the Contract. Approved samples will be returned and may be used in the work.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Refer to Contract Specifications Section 01 60 00 - Product Requirements, for general requirements for delivery, storage, and handling procedures.
- B. Do not deliver accessories to the Jobsite until rooms in which they will be located are ready to receive them for immediate installation.
- C. Pack accessory items individually in a manner to protect accessory item and its finish.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Stainless Steel Sheet: ASTM A167, commercial grade, 22 gage, satin finish.
- B. Stainless Steel Tubing: ASTM A269, commercial grade, seamless, satin finish.
- C. Adhesive: Epoxy type contact cement.
- D. Anchors and Fasteners:
 - 1. Provide concealed fasteners where possible. Concealed fasteners shall be 300-Series stainless steel or galvanized steel conforming with ASTM A153/A153M, as appropriate. Exposed fasteners shall be 300-Series stainless steel.
 - 2. Provide self-drilling, self-tapping, corrosion-resistant steel screws, conforming with ASTM C1002, where accessories are to be anchored to concealed backing plates 16 gage or less in thickness.
 - 3. Provide galvanized expansion type anchors with matching galvanized screws, bolts, or studs where accessories are to be anchored to concrete or masonry. Provide galvanized steel washers under all screw heads, bolt heads, and nuts.
- E. Janitor Shelving: ASTM A167, Type 304, composite stainless steel panel, free of buckles, waves, and surface imperfections, satin finish. Size as indicated.

- F. Locks shall be tumbler type. All keyed accessories shall be keyed to conform to "CAT74" keying, except coin boxes of vending equipment.

2.02 FABRICATION

- A. Weld and grind smooth joints of fabricated components. Welded joints shall be invisible in the finished work.
- B. Form exposed surfaces from one sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents. Shelf edges shall be returned and hemmed. There shall be no sharp edges in the finished work.
- D. Shop assemble components and package complete with anchors and fittings.

2.03 ACCESSORIES

- A. General: Regarding accessories designated as District Designated Matching Products (DMP), refer to Contract Documents for product name brand and model number.
- B. Janitorial Shelf: 12 inches wide, 16 gage, Type 304 stainless steel, satin finish, with 3/4 inch or one inch returned edge, hemmed. Length of shelf shall be as indicated. Provide painted steel support brackets as required.
- C. Clothes Rod: Nominal 1-1/4 inch diameter, heavy-duty stainless steel tube or pipe, Type 304, satin finish. Provide complete with stainless steel mounting flanges.
- D. Seat cover dispensers - public: DMP. Wall-mounted behind and above toilet. Unit is recessed and keyed.
- E. Seat cover dispensers - staff: DMP. Same as public except where recessing the unit is not possible, use surface-mounted, keyless; this exception shall apply to staff rooms only.
- F. Sanitary napkin disposal – public: DMP. Wall-mounted behind and above toilet. Unit is recessed and keyed.
- G. Sanitary napkin disposal – staff: DMP. Same as public except where recessing the unit is not possible, use surface-mounted, keyless; this exception shall apply to staff rooms only.
- H. Towel dispensers - staff only toilets: DMP. Unit is surface-mounted and keyed. Where combination towel and waste receptacle is indicated, use recessed unit, keyed.
- I. Toilet roll and tissue dispensers – public: Recessed, District furnished.
- J. Toilet roll and tissue dispensers – staff: DMP. Double roll, keyed.
- K. Soap dispensers – public: DMP. Wall-mounted above lavatory, recessed, vandal resistant with pump.

- L. Soap dispensers – staff: DMP. Same as public except where recessing the unit is not possible, use surface-mounted; this exception shall apply to staff rooms only.
- M. Mirrors – staff only: DMP. Framed glass mirror, 18” x 30”.
- N. Hand dryer – public and staff: DMP. 120V, wall-mounted unit. Projection from wall: 5-5/16 inches. Sensor-operated, white.
- O. Robe Hook: Single robe hook, stainless steel with satin finish, projects 1 5/8 inch minimum, concealed fasteners.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Deliver inserts, backing plate mounting kits, and rough-in-frames to Jobsite at appropriate time for incorporating all such items into the construction. Provide templates and rough-in measurements as required.
- B. Before starting work, correct any conditions detrimental to installation or operation of units.

3.02 INSTALLATION

- A. Locate accessories as indicated. Provide one soap dispenser per lavatory. Provide one mop holder for each Janitor's Room service sink. Provide a minimum of one robe hook at disabled accessible height and one robe hook at conventional height at each single person toilet room.
- B. Install fixtures, accessories, and items in accordance with the manufacturer's installation instructions and recommendations. Use security type fasteners.
- C. Install true, plumb, and level, securely and rigidly anchored to backing plates, blocking, and reinforcement in the substrate construction.
- D. Soap dispensers shall be located directly over lavatories in such a manner that the nozzle discharge shall fall into the lavatory bowl.

3.03 SCHEDULE OF TOILET ACCESSORIES

- A. Refer to the Contract Specifications and Drawings for scheduled toilet and bath accessories.

END OF SECTION 10 28 24

SECTION 10 40 00

SAFETY SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

1.02 RELATED SECTIONS

- A. Fire hose cabinets are specified in Section 05 70 00 - Decorative Metal.
- B. Recessed fire hose cabinet are specified in Section 21 12 00 – Fire-Suppression Standpipe.

1.03 MEASUREMENT AND PAYMENT

- A. General: Fire extinguishers and cabinets will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.04 REFERENCES

- A. California Code of Regulations (CCR):
 - 1. Title 24, California Fire Code, Portable Fire Extinguishers
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 10 Portable Fire Extinguishers

1.05 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data and Samples, for submittal requirements and procedures.
- B. Shop Drawings and Product Data: Submit Shop Drawings of installation details and manufacturer's product data for fire extinguishers, extinguisher cabinets, and installation accessories.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS

- A. Multi-Purpose Dry Chemical Extinguishers: Provide nominal 5-pound or 20-pound capacity extinguishers as indicated, rated as follows, unless otherwise noted:
 - 1. 5 Pounds: UL Rating of 3A-10B:C. For station agent's booth.
 - 2. 20 Pounds: UL Rating of 20A-120B:C. All other locations, except where carbon dioxide

extinguishers are required.

- B. Carbon Dioxide Extinguishers: Provide nominal 20-pound capacity extinguishers as indicated, rated as follows:
 - 1. 20 Pounds: UL Rating of 10-B:C. One for each electrical room and train control and communications room.
- C. Mounting Brackets: When extinguishers are indicated to be wall mounted without cabinets, provide manufacturer's mounting brackets for sturdy, top and bottom support, properly sized for type and size of extinguisher, and to resist lateral forces from a design seismic event.

2.02 FIRE EXTINGUISHER CABINETS

- A. Cabinets: Extinguisher cabinets shall be fully recessed type with flat trim or semi-recessed type with rolled edge as indicated. Cabinets at parking structures may be surface mounted with rolled edges and radiused corners. Cabinets shall be of size required for size of extinguisher, fabricated from Type 304 stainless steel with No. 4 finish, with solid stainless steel door. Provide fire-rated cabinets where recessed in fire-rated walls.
 - 1. Door shall be lockable. Furnished with flush type stainless steel door pull, with spring loaded catch activated by a pull device. Latch shall be replaceable and vandal resistant.
 - 2. Joints in cabinets shall be made watertight, and doors shall be gasketed to minimize moisture intrusion. Provide weep holes in bottom of cabinet.
- B. Cabinet Identification
 - 1. Cabinets shall be labeled with the words "FIRE EXTINGUISHER" in one inch high letters, San Serif, Universal 65 or Helvetica style.
 - 2. Letters shall be black in color for stations and red in color for parking structure, as selected by the Engineer. The letters shall be provided for all cabinets; standard applied die cut letters, one inch high minimum, san serif font, all capital letters.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that space in fire hose cabinets is sufficient to receive indicated fire extinguishers.

3.02 INSTALLATION

- A. Install fire extinguishers and extinguisher cabinets plumb and level as indicated. Install securely in place in accordance with the manufacturer's installation instructions and in compliance with applicable requirements of the California Fire Code and NFPA 10.

END OF SECTION 10 40 00

SECTION 10 51 19

METAL LOCKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers.
- B. Locker benches.

1.02 MEASUREMENT AND PAYMENT

- A. General: Metal lockers and benches will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.03 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data and Samples, for submittal requirements and procedures.
- B. Shop Drawings and Product Data: Submit fully detailed Shop Drawings and manufacturer's product data of metal lockers and benches, including layout of lockers, color chips, and installation details. Include pedestal anchorage details for benches.
- C. Samples: Submit locker manufacturer's standard color samples for selection. Submit 6 inches by 9-1/2 inches (full width) by 1-1/4 inch samples of finished bench top.

PART 2 - PRODUCTS

2.01 LOCKERS

- A. Type and Manufacture: Lockers shall be Standard Single Tier or Double Tier and Accessible Single Tier or Double Lockers of width, depth, and height as indicated. Lockers shall be furnished with sloping tops, raised bases, fillers as needed, panel ends, anchors, fasteners, and accessories as required for a complete and finished installation. Lockers shall be manufactured to meet or exceed the following requirements:
 - 1. Locker Units: Size and configuration as indicated.
 - 2. Bodies: Minimum 24 gage sheet steel, formed and flanged with stiffener ribs; electrically spot welded. Bolt spacing shall not exceed 9 inches on center.
 - a. Do not install mounting fasteners through the bottom of the lower locker unless it is within 1-1/2 inches of the hinge side or the back of the locker.
 - 3. Door Frame: Minimum 16 gage sheet steel, formed channel shape, welded and ground flush, welded to locker body.
 - 4. Doors: Minimum 18 gage sheet steel, formed channel shape at vertical edges, flanged at top and bottom, with louvers at top and bottom of door face.

5. Locker Top, Closure Panels, and Trim: Provide end panels and filler panels to close off all openings. Provide continuous sloping top. Top, panels, and trim shall be minimum 20 gage sheet steel. Finish edges smooth without burrs.

B. Hardware:

1. Door Handle: Door handle and latching mechanism shall be the manufacturer's accessible lever handle with integral feature for locking the door with a padlock, manufactured from a chrome-plated non-corrosive alloy.
2. Hinges: Provide two hinges for doors under 42 inches in height and three hinges for doors over 42 inches in height. Weld hinges securely to locker frame and rivet securely to the door.

- C. Number Plates: Polished aluminum or stainless steel with 1/2-inch high black figures. Numbering shall be provided, beginning with the number 100 and numbered consecutively thereafter.

- D. Finish: Lockers, all exposed parts exterior and interior, panels, and enclosures, shall be bonderized or phosphatized to assure maximum paint adherence, primed with a corrosion-inhibitive metal primer, and finished with manufacturer's baked enamel in color as selected by the Engineer from manufacturer's standards.

2.02 LOCKER BENCHES

- A. Benches shall be manufactured from laminated maple mounted on steel tube pedestals, as follows:

1. Pedestals and Anchors: Pedestals shall consist of 1-1/2 inch nominal diameter steel tube with 10 gage steel flanges welded to each end. Welds shall be ground and dressed smooth. Provide anchorage with 1/2-inch diameter galvanized steel expansion type anchor bolts as specified in Section 05 50 00 - Metal Fabrications. Provide finish for pedestals as herein specified for lockers.
2. Bench Tops: Laminated maple, 1-1/4 inches in full finished thickness by 9-1/2 inches wide. Provide bench tops with clear penetrating lacquer or polyurethane finish, satin in texture.
3. Overall Bench Height: 18 inches nominal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Lockers and benches shall be installed as indicated and in accordance with the approved Shop Drawings and the manufacturer's installation instructions and recommendations. Install lockers and benches in a rigid and substantial manner, straight and plumb, with all horizontal lines level.
- B. Anchor lockers with appropriate anchor devices to suit materials encountered. Bolt adjoining

METAL LOCKERS

locker units together to provide rigid installation. Install sloping top, end panels, and filler panels to completely close off openings.

1. Bolts in bottom of locker shall be within 2 inches of the back or hinged side walls.
- C. Adjust and lubricate hardware for proper operation after installation. Doors shall be free from hinge bind after installation.
- D. Clean lockers and benches on completion of work and leave free from imperfections. Protect from damage until Contract acceptance.
- E. Lockers shall be secured to the wall to resist lateral forces from a seismic event. Fastenings shall be designed by the Contractor to resist calculated loads of full lockers.

END OF SECTION 10 51 19

BART Facilities Standards (BFS)

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5.11 Division 11

Equipment

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SECTION 11 31 00

RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Refrigerators.
- B. Microwave ovens.

1.02 MEASUREMENT AND PAYMENT

- A. General: Residential appliances will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for Architectural Work.

1.03 SUBMITTALS

- A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Product Data: Submit description of unit kitchen components, including materials and finishes.
- C. O&M Instructions: Submit manufacturer's operation and maintenance instructions in accordance with the requirements of Section 01 78 23 - Operation and Maintenance Data, for off-the-shelf manuals.

PART 2 - PRODUCTS

2.01 RESIDENTIAL APPLIANCES

- A. Type and Manufacture: Provide standard manufactured appliances as indicated. Appliances shall be white.
- B. Microwave Oven: Provide a countertop microwave oven, 1.4 cubic foot capacity. Electrical requirements: 120 V, 1.2 kW, 10 A. Minimum 1100 watts. Maximum width 23 inches. Microwave oven shall be a plug-in type appliance and approved by a nationally known testing laboratory.
- C. Conventional Refrigerator with Freezer: Provide 18.2 cubic feet top freezer refrigerator, frost-free, with lighting at fresh food compartment and interior up-front controls. Refrigerator shall qualify for EPA /DE Energy Star product labeling program. Freezer capacity shall be minimum 4 cubic feet and fresh food capacity shall be minimum 14 cubic feet. Provide with two ice cube trays. Refrigerator shall be plug-in type. Electrical requirements, 115V, two wire, 60 Hz, and shall be approved by a nationally known testing laboratory.

- D. Removable Undercounter Refrigerator: Refrigerator shall have a minimum capacity of 5.8 cubic feet. In the fresh food compartment the refrigerator shall have three full-width shelves, three shelves on the door, and light. Provide with two ice cube trays. The temperature control shall be mounted in the interior of the refrigerator cabinet. Defrost control: Automatic. Refrigerator shall be plug-in type, 115 V ac, two-wire, 60 Hz, and shall be listed or approved by a nationally known testing laboratory. Refrigerator shall be selected to fit under countertop indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install appliances as indicated and in accordance with the manufacturer's installation instructions and recommendations.
- B. In addition to complying with O&M manual submittal requirements specified herein, include one copy of each appliance's standard owner's manual in the cabinetry adjacent to the appliances for convenient of users. Enclose manuals in heavy duty plastic bag, such as zip-loc freezer bag.

END OF SECTION 11 31 00

5.12 Division 12
Not Used

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5.13 Division 13
Not Used

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